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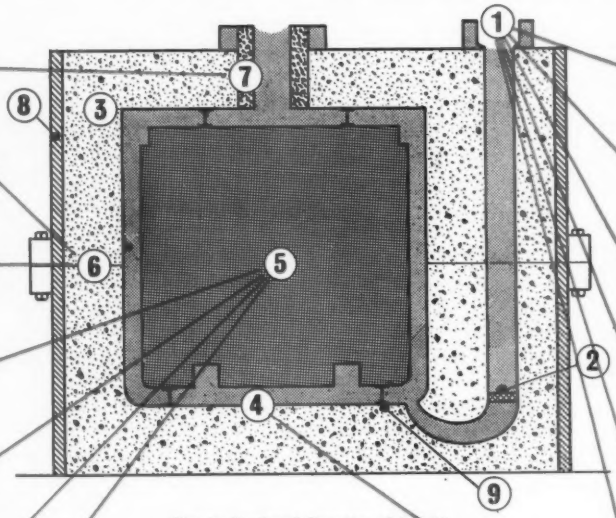


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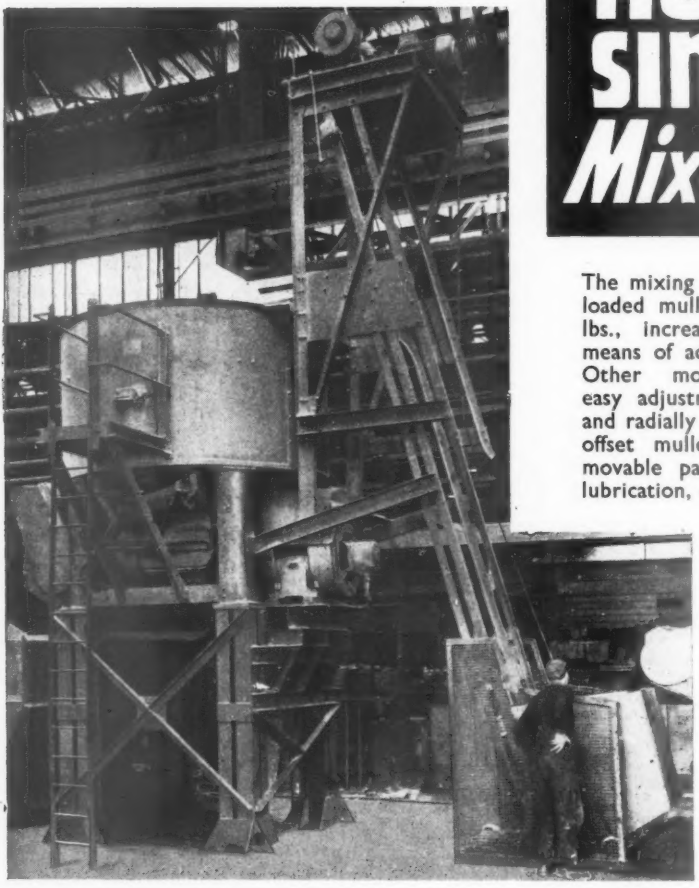
# Modern SAND MIXING PLANT

## AUGUST-SIMPSON Mix-Mullers



The mixing unit incorporates spring-loaded mullers, each weighing 1,600 lbs., increasing to 4,000 lbs. by means of adjustable spring pressure. Other modern features include easy adjustment of plows vertically and radially by positive screw device; offset mullers; sand sampler; removable panel in crib; centralised lubrication, etc.

Photograph shows a No. 3F size August-Simpson Mix-Muller Bucket Loader and independently driven Aerator. Large batch capacity — approximately 4,000 lbs.

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FOUNDRY
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Vol. 107 NOVEMBER 5, 1959 No. 2239

## Ministry for Science

Lord Hailsham at a Press conference, called to introduce himself as head of the new Ministry of Science, devoted the major part of his speech to telling his audience of the many aspects of scientific activities which he as the Minister would leave severely alone for the good work that was being done to continue. Many of the Ministries, such as Education, Power, Transport, Agriculture and Health, were concerned with scientific developments and their activities in this direction would still be under their own control. However, he intended, he said, to utilize to the full the Government's Advisory Council on Scientific Policy—a body composed of Government and other scientists—and by so doing, he would strive to make "the voice of science coherent and articulate under Government encouragement, and in a real sense to make science self-governing under Government inspiration."

Perhaps in this context, the most significant statement made was that he looked forward to receiving at an early date a report from the committee set up under the chairmanship of the late Sir Claude Gibb (now chaired by Sir Solly Zuckerman) on techniques of management and control of Government-financed research and development. He also proposed, he said, to show a personal interest in applied research carried out by private industry and in industrial research associations under the general authority of the Department of Scientific and Industrial Research. The underlying principle of the new Ministry was to be one of long-term policy—that of enhancing British prestige in the world, and with it, prosperity and culture, he concluded.

From the industrial point of view, the general census of opinion is that more and better research is a necessity, but many people feel there is a certain amount of overlapping, possibly involving a waste of time and money. This aspect is more apparent than real, as those in charge of research stations do in fact co-operate to avoid repetition. So far as those covering the metallurgical industries are concerned, the co-operation is close and no specific research is duplicated. Moreover, when matters of joint interest are undertaken, such as in determining factors which affect the "life" of ingot moulds, then a common attack is made on the problem by the research associations concerned. We are convinced that for the three research associations which cater for the foundry industry, their streamlining into one huge concern, would be a retrograde step and one much deplored by those utilizing their services.

**DAVID BROWN, M.I.Mech.E., F.R.Ae.S.**

*Chairman and Managing Director, David Brown Corporation, Limited.*

*Featuring . . . .*

**DAVID BROWN, M.I.Mech.E., F.R.Ae.S.**

MR. DAVID BROWN, chairman and managing director of the David Brown Corporation, Limited—a concern employing over 10,000 people—was born in Huddersfield in 1904. The David Brown business was started by his grandfather, a patternmaker by trade, who specialized in the making of wood patterns for gear work, and to-day, gearmaking forms a major activity in his firm's operations. In addition to catering for the requirements of the group's engineering divisions, the Corporation's foundry at Penistone, near Sheffield, services British industry as a whole with steel and bronze castings. Here, the Randupson cement/sand method was pioneered and to this day, the Penistone foundry is the only one in the country operating this system for the production of steel castings, though it has been successfully exploited by the makers of non-ferrous propellers.

Mr. Brown was educated privately and at Rossall School. He joined the family gearmaking business at the age of 17 as an apprentice, and by the time he was 25, was appointed a director, and four years later was made managing director. From then onwards, the firm expanded to include the manufacture of tractors and motor cars. This latter activity had its origin in Mr. Brown's youthful participation in motor racing, a sport in which he won a number of trophies. Since (during 1947/48) he acquired the Aston Martin and Lagonda companies, he has so revitalized their activities that this year his team won the Sports Car World Championship. All his hobbies centre around racing and speed. Mr. Brown holds a pilot's certificate and makes extensive use of his organization's private aircraft—a de Havilland Dove, based on an airstrip near Huddersfield. His stables breed hunters and steeplechasers, whilst a further hobby is that of yachting—Mr. Brown is a member of the Royal Thames Yacht Club. A unique honour was bestowed on Mr. Brown in January of this year when he was inaugurated Chief Flying Sun of the Iroquois Tribe of the Mohawk Nation in Toronto. He is a member of the Institution of Mechanical Engineers, an Associated Fellow of the Royal Aeronautical Society, an Underwriting member of Lloyd's, and a Freeman of the City of London.

# National Works Visits Day

*Record Attendance in London on October 30*

The tenth National Works Visits Day function, organized this year in London by the Institute of British Foundrymen, brought a record attendance of members to the Metropolis. This is the one day in the year when members of the Institute from all over the country make up parties for visits to foundries in a particular area, thus supplementing works visits arranged at the time of the Institute's annual conference. This year, about 230 foregathered for the visits to the eight works* which had issued invitations —Ford Motor Company, Limited (Thames and Dagenham foundries); K. & L. Steelfounders and Engineers, Limited (Letchworth); Langley Alloys, Limited and G. D. Peters & Company, Limited (grouped visit in the Slough area); British Bath Company, Limited, and Le Grand Western Foundries, Limited (grouped visit in the Greenford/Southall area); Broom & Wade, Limited (High Wycombe) and R. & A. Main, Limited (Edmonton). All the parties left central London by coach in the early morning, returning there in the evening, luncheon and tea being taken with one or other of the host companies according to the party arrangements. In the evening, as is the custom, the parties of members reassembled for dinner at which representatives from the firms visited were honoured guests.

### Dinner

The dinner in the evening was held in Lyons Corner House, Tottenham Court Road, London, and about 160 attended. The chair was taken by Mr. John Bain, A.M.I.MECH.E., president of the London branch, supported by the national president, Mr. C. H. Wilson, and a number of past-presidents and senior officials of the Institute. After the "Loyal Toast," the chairman proposed the health of the guests, mentioning them all and their firms by name and saying how much the Institute was indebted to them for giving such a grand welcome to the parties and dispensing such lavish hospitality. He referred jocularly to the original circular about the programme which had described the function as the tenth "experiment" in the series. In foundry parlance, he said, if it needed ten trials to decide how to make a casting, he wondered when a "Good 'un" would be made! It seemed quite clear from the success that attended these functions that they were already incorporated as a very worthwhile event in the Institute's annual calendar. Mr. G. R. Webster (director, British Bath Company, Limited) replied for the guests, stressing how much these visits were always a matter of reciprocity, the hosts learning much from their visitors.

Mr. C. H. Wilson then voiced members' thanks to the London branch for organizing the function this year and went on to propound a new conception of the status of the occasion. He put forward the idea that because of the difficulty of organizing large national conferences always in an area where there were also adequate opportunities for works visits, it might be better to replace the works visits part of a national conference by attaching much greater importance to the National Works Visits Day functions. In response to several requests, Mr. R. B. Templeton then addressed the gathering. (It was when Mr. Templeton was president of the Institute that the first of these annual series of visits was organized.) He

(*Concluded at foot of column* 2)

*All these establishments were described briefly in the JOURNALS of October 22 and 29.

# *Forthcoming Events*

NOVEMBER 9

**Institute of British Foundrymen**

*Lancashire branch*:—"Light-alloy Castings," by T. Williams, 7 p.m., at the Midland Hotel, Manchester.

NOVEMBER 10

**Institution of Production Engineers**

*Birmingham graduate section*:—"Industrial Law," by R. A. Pratt, 7 p.m., at the James Watt Institute.

**Institute of British Foundrymen**

*Coventry section*:—"Services of the British Cast Iron Research Association to the Ironfounding Industry," by H. Morrogh, 7.30 p.m., Coventry Technical College, Room A5.

NOVEMBER 11

**Combustion Engineering Association**

*Northern region*:—Discussion of "Factors Affecting the Choice of a New Boiler Plant," 2.30 p.m., at the Royal Station Hotel, Newcastle-upon-Tyne.

**Institute of British Foundrymen**

*West Riding of Yorkshire branch*:—"Some Casting Defects—their Cause and Cure," by J. L. Francis, 7.30 p.m., at the Bradford Institute of Technology.

**Institute of Welding**

*South London branch*:—"Welding and Lloyd's," by G. M. Boyd, 7 for 7.30 p.m., at 54, Princes Gate, London, S.W.7.

**Institution of Production Engineers**

*Wolverhampton branch*:—Film evening: "Britain's Heaviest Steel Casting"; "Structural Steel at our Fingertips"; "Chips" and "Finding the Time," 7.15 p.m., at the Dudley & Staffs Technical College.

**Institution of Plant Engineers**

*Western section*:—"Developments in the Gas Industry," by W. A. Simmonds, 7.30 p.m., at the Grand Hotel, Broad Street, Bristol.

NOVEMBER 12

**Institute of Fuel**

*Merseyside sub-section*:—"Smoke Density and Various Aspects of Grit and Dust Emission," by P. G. W. Hawksley, 7 p.m., at the Liverpool Engineering Society's Rooms, 9, The Temple, Dale Street, Liverpool.

*Midland section*:—"Flue-gas Additives," by E. Brett Davies, 6.30 p.m., at the Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham, 2.

**Institute of British Foundrymen**

*Beds. & Herts section*:—Evening visit to the Norton Grinding Wheel Company, Limited, Welwyn Garden City, Herts, 7 to 8 p.m.

NOVEMBER 13

**Scientific Societies in South Wales and Monmouthshire**

"Research and Development in the DSIR Stations," by Sir Harry Melville, 6.45 p.m., in the Reardon-Smith Lecture Theatre, National Museum of Wales, Cardiff.

**Institute of British Foundrymen**

*East Anglian section*:—Dinner and social evening, 7 p.m., at the Oriental Cafe, Westgate Street, Ipswich.

NOVEMBER 14

**Institute of British Foundrymen**

*Scottish branch*:—"Production of Heavy General Engineering and Jobbing Castings using Air-set Cores," by A. Shirley, 5 p.m., at the Royal College of Science and Technology, George Street, Glasgow.

denied the suggestion that the original conception of the visits was his and graciously mentioned other officers of the Institute in this connection. He had only acted as a sponsor to put into concrete form the feelings of many at the time, he said.

The proceedings concluded with light entertainment, the whole evening's programme being excellently compèred by Mr. L. A. S. Harbourne. Thanks were expressed during the evening also to the secretariat of the London branch for the excellent general arrangements and to the stewards who had assisted in the detail working out of the day's events.

# Cost Control in the Foundry

*By D.A. Crooks**

**The application of a work study system to a foundry is considered in detail in this article, both theory and practice being dealt with. Useful hints are given on how to introduce controls into a works without causing friction with established departments. Specimen time-and-motion study sheets and graphs are set out, and two different systems of cost control are explained.**

The main objects of installing and operating a system of cost control are: (*a*) to reveal quickly true costs; (*b*) to eliminate all sources of waste, and (*c*) to expose unnecessary losses of time, effort and material—in the manufacture of individual or batch-type castings. Other objects are:

(1) To develop a practical and accurate approach to estimating, relative to actual conditions in the foundry.

(2) To establish accurate information on what is being done, why it is being done, how, where, when and by whom it is being done.

(3) To obtain harmonious working conditions, and to present, both to management and workers, facts which will be mutually beneficial.

### Factors Influencing Foundry Operation

Integrated with these objects are the three principal factors governing profitable operations in a foundry, which are:

(1) Correct estimation of the cost of manufacture of each individual casting.

(2) Ability to manufacture at this cost, and to produce the necessary data and information to establish that this has been done.

(3) Delivery of a sound dependable casting—in other words, tight control of defective castings.

### Estimating

Estimating is the initial stage of operations, and determines the complete cycle of events which is planned for each job. Firstly, it is the primary factor in gaining or losing work. Secondly, it is the yardstick to be used by managers and foremen in their duties, and also in their attitude towards control. Finally, estimating determines whether a profit or loss will result.

### Two Controls are Necessary

In this approach to control of cost, procedures in regard to the technique of manufacturing a casting (*i.e.*, sand technology, metallurgy, and casting quality) is basic to successful and profitable operation in any foundry. Hence, it is recommended that administration be divided into two controls:—

(*a*) Control of manufacturing and operational procedures—termed "Quality Control Department."

(*b*) Control of costs and economies involved in the manufacture of castings—termed "Standards Department," or "Work Study Department." This paper considers (*b*) in detail.

### WORK STUDY

"Standards" and "Work Study" must inevitably go together, because factual data must be available before any standard can be set. The standard in this instance is associated primarily with time, and therefore the function of the work study department is to study and record the "motions" of all elements of production, and elapsed "time" over any period. It is, of course, a fact that conditions vary between foundries, but whatever the peculiarities may be the basic principles associated with methods and personnel are fundamentally the same. These features of the foundry industry provide a foundation for the creation and successful operation of a standards or work study department.

### Cost Department Personnel

"Control of costs" demands control within the department responsible for its effective execution, therefore the department's personnel must be of the balanced type possessing a sound knowledge of foundry practices, and must have a strong character and pleasing personality. These qualities are essential for those who, in the course of their duty, must inevitably make changes in old-established methods, both at shop-floor level and in office routine. Such changes naturally unsettle the producer—the supervisory staff, also, must develop a new outlook on their responsibilities. The latter point requires special stress if the anticipated snags are to be smoothed out, for supervisors who are not receptive to progressive changes are continually retarding progress.

### MOTION STUDY

The first objective of any new cost control department is to establish a complete knowledge and written report on conditions in the foundry relative to: plant layout; mechanical aids; methods of production; personnel engaged; location of buildings, and material storage and administrative organization. This information can only be gathered by devoting long periods of time to continuous motion and observation studies in all sections of the

* The Author is foundry manager at Ashmore, Benson, Pease & Company, Limited.

foundry. In the course of this initial overall survey it is most probable that specific areas or operations may demand a more detailed study than normal, particularly where repetition work is involved. No less than six continuous cycles on work of this nature should be studied in order to ensure that almost every possible deviation is witnessed and accounted for.

## Sketches and Questions

At the same time as any study is being taken, it is a distinct advantage to make freehand sketches showing plan views of: building design; fixed plant location; works stations, and storage or placing of equipment. This build-up of general information can be further extended by questioning the men on the job about their conditions of work, for such voluntary statements sometimes reveal advantages,

TABLE 1.—*Time Study Sheet.*

| | | | | | |
|---|---|---|---|---|---|
| *Study No.* 26A | *Operation* Coremaking | | *Date* 27.1.53 | *Dept.* Mech. Fdry. | |
| *Patt. No.* L-OHH | *Client* Detrick | | *Dwg.* | *No. in Box* | *Cores* 1 |
| *Size:* *Wheel* / *Corebox* 16 by 4 by 3 in. deep / Wood in halves | | | *Volume* 40 cub. in. / *Area* 16 sq. in. | *Effort* Good / *Class* Average | |
| *Size:* *Pattern* / *Core* / *Plate* | | | *Loose Pieces* / *Chaplets* | *Gaggers* 1 / *Type* | |
| *Operator* Hunter | *Helper*— | | *Start* 10.34 | *Stop* 10.44 | *Elapse* 10 min. |

| *No.* | *Elements* | Cycles. 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | *Average* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Set box | — | 4 | 4 | 4 | 4 | 4 | 5 | 11 | | 4 |
| 2 | Place 2 clamps | 10 | 6 | 10 | 6 | 10 | 6 | 6 | 6 | | 7 |
| 3 | Place sand. Hand and tuck | 15 | 15 | 16 | M | 14 | 11 | 10 | 14 | | 14 |
| 4 | Ram (pin) | 12 | 14 | 14 | (25) | 15 | 17 | 16 | 16 | | 16 |
| 5 | Place iron | 5 | 5 | 8 | 6 | 7 | 8 | 7 | 5 | | 6 |
| 6 | Place sand | 3 | 4 | 4 | 7 | 9 | 4 | 4 | 5 | | 5 |
| 7 | Ram M. Sh. | 6 | 6 | 7 | — | 5 | 5 | 6 | — | | 6 |
| 8 | Place sand | 4 | 4 | 5 | — | — | — | — | — | | 4 |
| 9 | Flat ram | 5 | 5 | 5 | M | 4 | 4 | 6 | 8 | | 5 |
| 10 | Strike off | 9 | 7 | 8 | (12) | 6 | 6 | 6 | 9 | | 7 |
| 11 | Clean bench | 4 | 4 | 4 | — | 4 | 4 | 4 | 4 | | 4 |
| 12 | Remove clamps | 7 | 5 | 8 | 8 | 6 | 8 | 7 | 7 | | 7 |
| 13 | Move to plate and oven | — | 7 | M | 7 | 5 | 5 | 5 | 5 | | 6 |
| 14 | Draw half box | 7 | 6 | M | 5 | 5 | 5 | 5 | 8 | | 6 |
| 15 | Draw half box | 8 | 7 | (16) | 6 | 6 | 5 | 6 | 5 | | 6 |
| 16 | | 95 | 99 | 109 | 86 | 100 | 92 | 93 | 96 | | 7.70 |
| 17 | | | | | | | | | | | |
| 18 | Move tray conveyor | | | | 17 | | | | | | 0.17 |
| 19 | Observe 2.13 | | | | | | | | | | 2.13 |
| 20 | | | | | | | | | | | |
| 21 | 8 cores per tray | | | | | | | | | | |
| 22 | | | | | | | | | | | |
| 23 | No delay | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |
| 26 | | | | | | | | | | | |
| 27 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |

or bottlenecks, which are not discovered during the period of study. However, whether this diplomatic action is taken or not, it is essential that each section of the organization should be studied under all known variable conditions.

## ANALYSIS OF DATA

It is natural that a point will be reached when the work study team declare themselves satisfied with their collection of data, which should provide a complete picture of the foundry organization. Even at this preliminary stage a wealth of material should have been logged, and from an analysis of these facts a measure of efficiency may be established which will provide the foundation for formulating new procedures in the process of cost control.

### Selection of Appropriate Improvements

Analysis of the available data is likely to produce a variety of schemes which, in the opinion of the standards department, are necessary to achieve improved working conditions and increased production, with less fatigue and controlled costs, but such reorganization programmes normally call for capital expenditure. Furthermore, the movement or installation of plant may call for alterations to buildings, or a proposed change to benefit one section may completely disorganize another. Therefore, prior to any recommendation being made to the management, all aspects must be considered in the fullest detail. It is, of course, reasonable to expect that a company which is prepared to invest in the application of work study must also be ready to accept proposals put forward as the result of such work. However, it is important that practical changes be substantiated with relative degrees of efficiency, and also comparative costs of production. Information should be available from the accounts department regarding actual costs of production under existing methods and conditions of working, and from the new standards department regarding an accurate estimate of cost for either a whole, or sectional, reorganization.

### Influence of Annual Budgets, etc.

The nature of the recommendation submitted for approval by the management will naturally vary from foundry to foundry, but it is indeed rare if the best results can be achieved without immediate capital expenditure in some form or another, and this critical milestone in the progress of the new department requires a wise and sympathetic consideration by both parties. The standards department, in its enthusiasm, may fail to understand why the management is not inclined to embark upon immediate spending in this direction when such positive savings can be envisaged, whilst alternatively the management might expect results from this new approach to cost control without the company having to take calculated risks. There is value in both observations, and the correct conclusion is that the management spend wisely and in accordance with annual budgets, etc., but also give maximum encouragement on all aspects of the proposals, thereby dispelling any sense of frustration in the standards personnel.

### A Challenge

If a policy of no immediate capital expenditure has to be accepted, the standards department will in fact be meeting a challenge to prove the real value of work study. In this case, improvements such as: re-siting work stations; establishing flow lines within sections; providing services to encourage unbroken production cycles, and recommending changes in production methods to eliminate waste of time and effort, must be considered. Such changes may be considered bold and spectacular, but, when each in turn is made effective, the stage will be set for a further development in establishing standards of time for all direct operations on production.

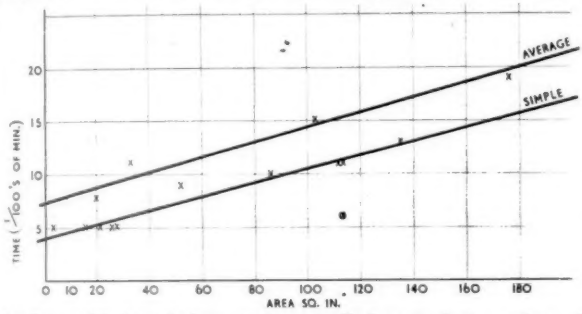



FIG. 1.—*Graph of time-studies regarding variable element "flat ram No. 5." This example is taken from hand core-making in the mechanical foundry, using female labour.*

## TIME STUDY

The attainment of this stage of cost control reveals how positive is the relationship between the factors What, Why, Where, When, Who, How, and the greatest factor and yardstick, *Time*. To evaluate any one of these is perhaps a major project in itself, but a constant reference to this combination of questions makes plain the full value of each. This combination forms the nucleus for every time study, and can be readily applied to the elements of moulding, coremaking and dressing, which are the three main phases of casting production.

*Cost Control in the Foundry*

### Preliminary Discussion

Making a time study in a foundry requires a technique embodying the following factors: (1) A practical knowledge of foundry work and terminology; (2) an appreciation of the degree of effort being imparted to the procedure; (3) the ability to take accurate time recordings of element breakdown at consistent breaking points, and (4) an intelligent application of notes on common or uncommon procedures. The personal approach to this work is of major importance, and often calls for tactful handling of delicate situations. Time study has never been acclaimed as a popular exercise, particularly by craftsmen. It is therefore vital that a co-operative attitude be established between the producer and the time study engineer. This condition is perhaps achieved most simply by having a brief preliminary discussion on the ultimate advantages of this fact-finding operation, provided that the producer performs in a way which contributes to a high standard of workmanship at the same time as displaying an appreciation of the need to save time.

### Time Study in a Jobbing Foundry

From this stage onwards the work study engineer will become a familiar figure on the shop floor, for the duration of this most important aspect of his work is never short. The number of individual job studies necessary will be controlled primarily

TABLE 2.—*Summary of Coremaking Time Studies, with Female Labour* (*continued on facing page*).

| *No.* | *Element.* | *Type, constant or variable)* | *Study Area Vol.* | 1A 176 380 | 2A 143 52 | 3A — — | 4A 9 5 | 5A 26 34 | 8A 135 139 | 9A 24 46 | 12A 16 33 | 13A 26 34 | 14A 113 120 | 15A — — | 16A 21 33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Set box .. .. | C | | 14 | 5 | | | | 5 | | 6<br>0·5 | 2 | 5 | | |
| 2 | Place clamps .. | V | | | | | 5<br>2 | | | | 10<br>2 | | | | 14<br>2 |
| 3 | Place sand .. | C | | 16 | 5 | | | 4 | 6 | 4 | 4 | | 11 | | 8 |
| 4 | Ram w. rammer pin .. .. | C | | 26 | | | | | 12 | 5 | 13 | | 16 | | 5 |
| 5 | Flat ram .. | V | | 19 | | | | 5 | 13 | | | 5 | 11 | | 5 |
| 6 | Strike off .. | C | | 30 | 20 | 6 | 4 | 4 | 12 | 5 | 31 | 6 | 35 | | 7 |
| 7 | Remove clamps.. | V | | | | | 4<br>2 | | | 5 | 4<br>2 | | | | |
| 8 | Part box .. | V | | | | | 5 | | | | | | | | 8 |
| 9 | Set core on plate | V | | | | 10<br>1 | 10<br>3 | | | | 6<br>1 | | | | 7<br>1 |
| 10 | Place irons .. | V | | | 5<br>1 | | | 4 | 4 | | 11<br>1 | | 11<br>2 | | |
| 11 | Place sand and tuck .. .. | V | | 65 | | 33 | | | 15 | | | 6 | | | |
| 12 | Place irons .. | V | | 94<br>9 | 5<br>1 | | | | | | | 4<br>1 | 26 | | |
| 13 | Ram w. rammer pin .. .. | C | | 16 | 8 | | | | | 4 | 30 | | 31 | | |
| 14 | Place sand .. | C | | 6 | 4 | | | | 4 | 5 | 10 | 2 | 36 | | |
| 15 | Place plate .. | C | | 9 | 5 | 8 | | | 11 | | | | 6 | | |
| 16 | Roll over .. | C | | 18 | 4 | 3 | | 5 | | 4 | 4 | | 5 | | |
| 17 | Rap and draw .. | C | | 17 | 5 | 10 | | 2 | 5 | 5 | 14 | 6 | 14 | | |
| 18 | Trim core .. | V | | 11 | 9 | | | | | | | | | | |
| 19 | Carry to st. and return | V | | 72<br>1 | | 22<br>4 | | | | | 37<br>4 | | 21 | | |
| 20 | Tuck w.h. .. | V | | | 5 | 10 | | | | | | | | | 7 |
| 21 | Gum iron .. | V | | | 6<br>1 | | | | | | | | | | |
| 22 | To conveyor .. | V | | | 7 | | | | 8 | 18 | | 11 | | | |
| 23 | Clean joint (trowel) | V | | | | 22 | | | | | | | | | |
| 24 | Get block pl. s. pops .. .. | V | | | | 14 | | | | | | | | | |
| 25 | Bed down block | V | | | | 11 | | | | | | | | | |
| 26 | R. sand and strike | V | | | | 36 | | | | | | | | | |
| 27 | Pl. sand ram .. | V | | | | 8 | 25 | 5 | | | | | | | |
| 28 | Draw loose piece | V | | | | 6<br>1 | | | | | 9<br>1 | | | | |
| 29 | Get and place drier | V | | | | 7 | | | | | 10 | | | | |
| 30 | Place sand pack | V | | | | 11 | | | | | | | | | |
| 31 | Roll over to ram | V | | | | 5 | | | | | 4 | | | | |
| 32 | Clean bench .. | V | | | | | 4 | 4 | | | 6 | | | | |
| 33 | Set ½ box .. | V | | | | | | | | | 7 | | | | |
| 34 | Rap box .. | V | | | | | | | | | 5 | | | | |
| 35 | Form ingates .. | V | | | | | | | | | | | | | |
| 36 | Pl. baked core .. | V | | | | | | | | | | | | | |
| 37 | Pl. lift eye .. | V | | | | | | | | | | | | | |
| 38 | Pl. in machine to draw .. .. | V | | | | | | | | | | | | | |
| 39 | Draw l. ring .. | V | | | | | | | | | | | | | |
| 40 | Pl. bl. s. frame .. | V | | | | | | | | | | | | | |
| 41 | Pl. black sand .. | V | | | | | | | | | | | | | |
| 42 | Tuck black sand | V | | | | | | | | | | | | | |
| 43 | Str. off bl. sand .. | V | | | | | | | | | | | | | |
| 44 | Remove frame .. | V | | | | | | | | | | | | | |

by the range of castings being produced. A jobbing foundry, which produces work of all sizes and degrees of complexity, demands a long and patient vigil. Nevertheless, it is this type of foundry which can reap the greatest benefit from work study, because, contrary to general opinion, predetermined time values can be established accurately for every operation in casting production.

### Two Different Techniques

It is perhaps fitting at this point to draw attention to the fact that, although time study is the only common base on which to establish predetermined operational times, it allows of at least two different techniques which may be developed and applied to estimating and/or price fixing. It will be readily understood that, for small repetition work associated with either machine-moulding, light coremaking or mechanical dressing, a greater degree of accuracy in assessing allowed time is necessary, in contrast to the longer-cycle work necessary with operational times in excess of 15 min. These two conditions are therefore considered under the respective headings of "Element Standards" and "Classified Standards."

### *"Element Standards"*

"Element Standards" of time are established from a somewhat detailed analysis of the information contained in Time Studies, whereas "Classified Standards" are derived from a more summarized version of total actual job time taken. Typical examples of the "Element Standards" method of tabulating every relevant factor are

TABLE 2.—*Summary of Coremaking Time Studies (using Female Labour).*

| *No.* | *Element.* | *Type, (constant or variable).* | *Study Area Vol.* | 17A 86 105 | 18A 20 20 | 19A 52 48 | 20A 103 112 | 21A 113 120 | 22A 113 120 | 23A 3 15 | 24A 33 76 | 25A 16 11 | 26A 16 40 | 27A 49 2½ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Set box | C | | | | 12 | 5 | 4 | 10 | 4 | 11 | 5 | 4 | 11 |
| 2 | Place clamps | V | | | | | | | | 11 | | | 7 | |
| 3 | Place sand | C | | 6 | 4 | 4 | 7 | 6 | 6 | 4 | 4 | 5 | | } 21 |
| 4 | Ram w. rammer pin | C | | 11 | 8 | | 26 | 10 | 10 | 10 | 6 | 14 | 16 | |
| 5 | Flat ram | V | | 10 | 8 | 9 | 15 | 11 | 6 | 5 | 11 | | 5 | |
| 6 | Strike off | C | | 12 | 11 | 15 | 16 | 26 | 28 | 5 | 29 | 9 | 7 | |
| 7 | Remove clamps | V | | | | | | | | 7 | | | 7 | |
| 8 | Part box | V | | | | | | | | 9 | | | | |
| 9 | Set core on plate | V | | | 12 | | 6 | | | 9 | | 7 | 6 | |
| 10 | Place irons | V | | 10 | 6 | 6 | 13 | 9 | 14 | 1 | | 1 | 1 | 6 | 13 |
| 11 | Place sand and tuck | V | | 4 | | 10 | | | | | 26 | 22 | 14 | | 1 |
| 12 | Place irons | V | | | | | | 15 | 18 | | | | | | 16 |
| 13 | Ram w. rammer pin | C | | | | | | 21 | 33 | | 15 | | 6 | } 28 |
| 14 | Place sand | C | | | 3 | 4 | 6 | 25 | 28 | | 23 | 5 | 9 | |
| 15 | Place plate | C | | | | 4 | 9 | 6 | 6 | | 8 | 4 | | 7 |
| 16 | Roll over | C | | 10 | 6 | 5 | 4 | 5 | 5 | | 5 | 4 | | 6 |
| 17 | Rap and draw | C | | 6 | 8 | 5 | 9 | 6 | 7 | | 8 | 7 | 12 | 20 |
| 18 | Trim core | V | | | 13 | | | 11 | 17 | | | | | 45 |
| 19 | Carry to st. and return | V | | | | | | | | | | | | 11 |
| 20 | Tuck w.h. | V | | | | 12 | | | | | | | | 32 |
| 21 | Gum iron | V | | | | | | | | | | | | 3 |
| 22 | To conveyor | V | | 20 | 22 | 9 | 18 | 13 | 26 | | 11 | 6 | | |
| 23 | Clean joint (trowel) | V | | | | | | | | | | | | |
| 24 | Get block pl. s. pops | V | | | | | | | | | | | | |
| 25 | Bed down block | V | | | | | | | | | | | | |
| 26 | R. sand and strike | V | | | | | | | | | | | | |
| 27 | Pl. sand ram | V | | | | | | | | | | | | |
| 28 | Draw loose piece | V | | | | 5 | | | | | | 7 | | 32 |
| 29 | Get and place drier | V | | | | 1 | | | | | | 1 | | |
| 30 | Place sand pack | V | | | | | | | | | | | | |
| 31 | Roll over to ram | V | | | | | | | | | | | | |
| 32 | Clean bench | V | | 6 | | | | | 9 | | | | 4 | |
| 33 | Set ½ box | V | | | | | | | | | | | | 11 |
| 34 | Rap box | V | | | | | | | | | | | | |
| 35 | Form ingates | V | | | 10 | | | | | | | | | |
| 36 | Place baked core | V | | | 11 | | | | | | | | | |
| 37 | Place lift eye | V | | | | | | | | | 14 | | | |
| 38 | Pl. in machine to draw | V | | | | | | | | | 4 | | | |
| 39 | Draw l. ring | V | | | | | | | | | 9 | | | |
| 40 | Pl. black sand frame | V | | | | | | | | | | | | 7 |
| 41 | Place black sand | V | | | | | | | | | | | | 14 |
| 42 | Tuck black sand | V | | | | | | | | | | | | 5 |
| 43 | Str. off black sand | V | | | | | | | | | | | | 8 |
| 44 | Remove frame | V | | | | | | | | | | | | 5 |

TABLE 3.—*Time Values for Coremaking in Mechanical Foundry (Manufacture by hand using Female Labour).*

| *Number.* | *Constant element.* | *Constant time.* D | A | S | *Variable time.* D | A | S | |
|---|---|---|---|---|---|---|---|---|
| 3, 4, 11, 13, 14, 27 | Place sand and ram .. .. .. .. .. | 0.46 | 0.14 | 0.06 | 0.022 | 0.020 | 0.013 | |
| | | | | | 0.022 | 0.020 | 0.013 | per 10 cub. in. |
| 1 | Set box .. .. .. .. .. .. | 0.033 | 0.03 | 0.013 | 0.018 | 0.006 | 0.003 | |
| 6 | Strike off .. .. .. .. .. .. | 0.21 | 0.08 | 0.03 | 0.019 | 0.012 | 0.01 | |
| 15 | Place plate .. .. .. .. .. .. | 0.035 | 0.035 | 0.035 | 0.003 | 0.003 | 0.003 | |
| 16 | Roll over .. .. .. .. .. .. | 0.05 | 0.05 | 0.05 | — | — | — | |
| 17 | Rap and draw .. .. .. .. .. .. | 0.10 | 0.05 | 0.02 | 0.010 | 0.007 | 0.003 | |
| | | 0.888 | 0.385 | 0.208 | 0.050 | 0.028 | 0.019 | per 10 sq. in. |
| | *Variable elements.* | | | | | | | |
| 22 | Cores to conveyor .. .. .. .. .. | 0.085 | 0.085 | 0.085 | — | — | — | per tray. |
| 20 | Tuck with hands.. .. .. .. .. .. | — | — | — | 0.057 | 0.025 | — | per 10 cub. in. |
| 5 | Flat ram .. .. .. .. .. .. | 0.075 | 0.075 | 0.04 | 0.007 | 0.007 | 0.006 | per 10 sq. in. |
| 10-12 | Place irons .. .. .. .. .. .. | 0.06 | 0.02 | — | 0.12 | 0.10 | 0.05 | per iron. |
| 9 | Set cores on plate .. .. .. .. .. | 0.075 | 0.05 | 0.05 | 0.02 | 0.015 | 0.015 | per core. |
| 8 | Part box .. .. .. .. .. .. | 0.045 | 0.045 | 0.045 | 0.012 | 0.012 | 0.012 | per 10 cub. in. |
| 2-7 | Place clamps .. .. .. .. .. .. | 0.18 | 0.14 | 0.09 | — | — | — | per 2 clamps. |
| 28 | Draw loose-piece .. .. .. .. .. | 0.01 | 0.01 | 0.01 | 0.06 | 0.06 | 0.06 | per piece. |
| 29 | Get and place drier .. .. .. .. | | 0.08 | | | | | |
| 30 | Place sand packs.. .. .. .. .. | | 0.11[3] | | | | | |
| 31 | Rollover to ram .. .. .. .. .. | | 0.05 | | | | | |
| 32 | Clear bench .. .. .. .. .. | | — | | | | | |
| 33 | Set ½-box .. .. .. .. .. .. | | 0.09 | | | | | |
| 34 | Rap box .. .. .. .. .. .. | | 0.05 | | | | | |
| 35 | Form ingates .. .. .. .. .. | | 0.10[3] | | | | | |
| 36 | Place baked core .. .. .. .. .. | | 0.11 | | | | | |
| 37 | Place lift eye .. .. .. .. .. | | 0.14[1] | | | | | |
| 38 | Place box in machine to draw .. .. .. | | 0.04 | | | | | |
| 39 | Draw loose ring .. .. .. .. .. | | 0.09 | | | | | |
| 40 | Place bl. sand frame .. .. .. .. | | 0.07 | | | | | |
| 41 | Place black sand .. .. .. .. .. | | 0.14 | | | | | |
| 42 | Tuck bl. sand .. .. .. .. .. | | 0.05 | | | | | |
| 43 | Str. off bl. sand .. .. .. .. .. | | 0.08 | | | | | |
| 44 | Remove Frame .. .. .. .. .. | | 0.05 | | | | | |

TABLE 4.—*Mechanical Foundry Coremaking Standards ("Element Standards" Job card).*

Client: *Weyburn Eng. Co.* Part No. *17431* Enq. No. Date
Box size Area *67 sq. in.* Vol ½ Vol. ½ Total vol. *220 cub. in.*
Details: *Split wood box. 2 clamps. 1 ring iron. 1 rod. 1 vent. Roll over.*

| Class: *Average* Constants. | | C | V | T |
|---|---|---|---|---|
| Cons. time | D. | 0.703 | | |
| ,, ,, | A. | 0.250 | | *0.250* |
| ,, ,, | S. | 0.103 | | |
| V. time 10 sq. in. | D. | | 0.037 | |
| ,, ,, ,, | A. | | 0.018 | *0.126* |
| ,, ,, ,, | S. | | 0.013 | |
| V. time 10 cub. in. | D. | | 0.0122 | |
| ,, ,, ,, | A. | | 0.020 | *0.440* |
| ,, ,, ,, | S. | | 0.013 | |
| Total forward | | | | *0.816* |

| Class Variables. | | C | V | T |
|---|---|---|---|---|
| Cores to con. tray | | 0.085 | | *0.085* |
| Tuck W.H/S 10 cub.in. | D. | | 0.057 | |
| ,, ,, ,, | A. | | 0.025 | |
| ,, ,, ,, | S. | | 0.025 | |
| Part box 10 cub. in. | D. | | | |
| ,, ,, ,, | A. | 0.045 | 0.012 | *0.309* |
| ,, ,, ,, | S. | | | |
| Flat ram 10 sq. in. | D. | 0.075 | 0.007 | |
| ,, ,, ,, | A. | 0.075 | 0.007 | *0.124* |
| ,, ,, ,, | S. | 0.040 | 0.006 | |
| Place irons each | D. | 0.060 | 0.120 | |
| ,, ,, ,, | 2A | 0.020 | 0.100 | *0.220* |
| ,, ,, ,, | S. | — | 0.050 | |
| Set on plate each | D. | 0.075 | 0.020 | |
| ,, ,, ,, ,, | A. | 0.050 | 0.015 | |
| ,, ,, ,, ,, | S. | | | |
| Brought forward | | | | *0.816* |
| Total forward | | | | *1.554* |

| Variables. | | C | V | T |
|---|---|---|---|---|
| Place clamps | D. | 0.18 | | |
| ,, ,, | A. | 0.14 | | *0.140* |
| ,, ,, | S. | 0.09 | | |
| Draw loose pieces ea. | | 0.01 | 0.060 | |
| Clean bench | | 0.05 | | *0.050* |
| Place plate 10 sq. in. | | 0.035 | 0.003 | *0.056* |
| Roll over 10 sq. in. | | 0.050 | | *0.050* |
| Rap and draw 10 sq. in. | | 0.100 | 0.010 | |
| ,, ,, ,, | A. | 0.050 | 0.007 | |
| ,, ,, ,, | S. | 0.020 | 0.003 | |
| Get and place drier | | 0.080 | | |
| Place and draw vent | 1 | | 0.100 | *0.100* |
| Brought forward | | | | *1.554* |
| Total Time | | | | *1.950* |
| *1.95* at *50* min. P/H. Cores P/H | | | | *25* |

shown under the following headings and in chronological order.

Table 1.—Time study sheet.
Table 2.—Summary chart.
Fig. 1.—Typical graph (required for each element).
Table 3.—Summation of facts from graphs.
Table 4.—"Element Standards" job card.

*"Classified Standards"*

For "Classified Standards," a modified version of Table 1 is shown on time study sheets (Table 5), also a working graph (Fig. 2).

### Complexity Classification

Apart from the common denominator of time study, which is vital to both techniques, it will be noted from the examples that terms of complexity classification (namely—simple, average and difficult) are used in both instances. There is a difference in application, however, these classifications being applied only to either individual or small groups of elements of repetition work, whereas the total cycle of operations is given a single classification for jobbing work.

### CHALLENGE TO MANAGEMENT

Space does not permit of further explanatory details of the establishment of predetermined standards of time, or of the use made of time studies to determine percentage allowances for normal delay time and self-service time. These two factors should have been reduced to a minimum as a result

TABLE 5.—*Time Study Sheet, Long Cycle (Classified Standards).*

*Study No.* 5 DAC *Operation* Coremaking Male. Main Shop *Date* 19.1.54 *Dept.* Core Bay

*Patt. No.* 12998 *Client* Min. Supply *Drg.* *No. in Box* 1 *Cores*

*Size:* *Wheel* *Corebox* 41 by 41 by 4 in. deep. *Flask* *Volume* 6,315 cub. ins. *Area* 1,680 sq. ins. *Class* Average

*Size:* *Pattern* *Core* *Plate* *Loose Pieces* *Chaplets* *Gaggers* *Type*

*Operator* Smith *Helper* None *Effort* Good. *Start* 2.29 *Stop* 3.08 *Elapse* 39 min.

| *No.* | *Elements.* | min./sec. | *Elements.* | min./sec. |
|---|---|---|---|---|
| 1 | Shovel sand (6) | 1.00 | Level sand and bed down | 1.10 |
| 2 | Level sand | 35 | Flat ram | 1.14 |
| 3 | Help mate bend bar | 60 | Strike off | 1.67 |
| 4 | Level sand and bed down | 45 | Jab vent (50) | 35 |
| 5 | Get sprigs | 12 | Draw 2 d. sprue | 14 |
| 6 | Place sprigs 23 | 73 | „ 2 „ „ | 16 |
| 7 | Level sand round (17 bosses) | 70 | Remove junk from Pl. | 84 |
| 8 | Ram sand (pin) | 95 | Lock and get 2 hooks | 75 |
| 9 | Shovel sand (pin) (4) | 40 | Cut 2 for lift. Eyes | 70 |
| 10 | Level sand and build up to box side | 95 | Wait for crane | 8.00 |
| 11 | Ram sand (pin) | 53 | Lift plate with crane | 90 |
| 12 | Away to wash grate. 10 paces | 1.09 | Lower on box with crane | 60 |
| 13 | Remove wash away | 10 | Set chains to r./o. | 1.20 |
| 14 | Carry to Box w./h. | 10 | Lift all W. Crane and | |
| 15 | Set grate | 20 | r./o. | 1.00 |
| 16 | Bed down with bar | 31 | Remove chains | 23 |
| 17 | Shovel sand (7) | 70 | Rap box | 44 |
| 18 | Level out and fix | 75 | Draw box w./h. | 20 |
| 19 | Ram sand (pin) | 3.75 | Draw r. bar 1 | 24 |
| 20 | Shovel sand (5) | 60 | „ „ „ | 10 |
| 21 | Level sand | 36 | Finish core | 20 |
| 22 | Ram sand (pin) | 2.25 | Stamp 8 numbers | 50 |
| 23 | Shovel sand (2) | 17 | Lift w. Crane and away | 65 |
| 24 | Level sand | 19 | *Actual job time* | 30 min. |
| 25 | Help mate draw | 30 | *Delay time* | 9 min. |
| | | | *Service time* | — |

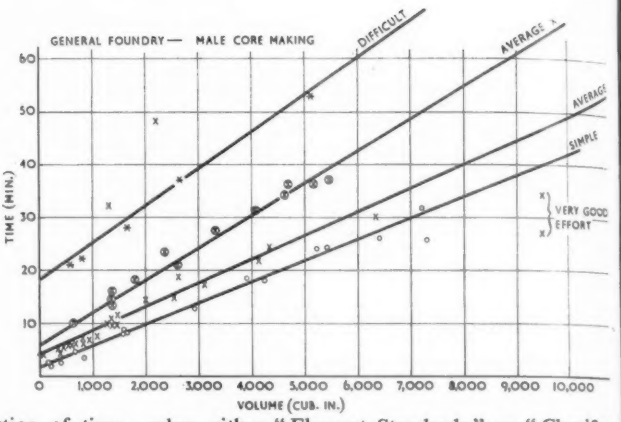



FIG. 2.—*Typical working graph for the establishment of "classified standards." This example concerns coremaking in the general foundry (male labour), for which the results are referred to four degrees of complexity.*

of earlier motion studies, but it is doubtful if any jobbing foundry can function entirely without either. Allowances such as these, however great or small, are a positive loss in potential productivity, and in consequence offer a distinct challenge to supervisory staff and management. Personal allowance is a must, and the proportion of time offered per hour or day is strictly a matter for joint consultation between trade union representatives and management.

## CONCLUSION

The work of a standards department should never completely stop, but a stage can be reached when either "Element Standards" or "Classification Standards," or both, have been established and accepted. This state of affairs is one of the most important milestones in the life of any foundry, for it can then be boasted that estimates of time are no longer "guestimates," and that the tools have been provided for control of all costs associated with time.

## British Progress in Shipbuilding

Press conference to hear the impressions of a British shipbuilding productivity team, composed of employer and trade union representatives, which has just returned from Sweden, was held in London last week. Mr. C. Stephenson, director and general manager of Hawthorn Leslie (Shipbuilders), Limited, Hebburn-on-Tyne (Co. Durham), and Mr. E. J. Hill, general secretary of the United Society of Boilermakers, agreed that British shipbuilding was no whit behind Sweden in technical advancement. On labour matters there was some divergence.

Mr. Stephenson pointed out that Sweden had only one union and that there was "complete flexibility of labour" with no difficulty in switching a man from one job to another. Sweden had no strikes because disputes were settled before strike action threatened. Mr. Hill thought the number of demarcation disputes in British yards would be less if foremen were consulted at the planning stage about the distribution of work, as was done in Sweden.

The team agreed that one reason for Sweden's greater productivity was that British yards operating with full order-books since the end of the war had had to modernize more slowly in order not to disrupt production programmes and Swedish yards are not so cramped for space to expand.

Other members of the team were Mr. George Barratt, general secretary of the Confederation of Shipbuilding and Engineering Unions, and Mr. Norman Sloan, director of the Shipbuilding Employers' Federation.

THE 10,673-TON TANKER El Morro is to be broken up by the Hughes Bolckow Shipbreaking Company, Limited, a Metal Industries group subsidiary, at Blyth (Northumberland). It is the third tanker to be allocated to the Blyth breakers in recent weeks: the other two were the Fort Stevens (10,639 tons) and the Omala (6,244 tons).

## Truth about Company Directors

A random sample to find out just how the average company director spends his working day has been taken by the medical research unit of the Institute of Directors. Questionnaires were sent to 5,000 of the Institute's 32,000 members and replies were received from 61 per cent. of the sample. The lie is given to a good many popular conceptions of the company director.

Once at the office, 90 per cent. spend three quarters of their time in executive work outside the boardroom; more than two out of three are at work by 9.30 a.m. and get there mainly in cars, 94 per cent. being owner-drivers. A fifth rely on public transport.

Last year three quarters took holidays of three weeks or less; about a third lunch at work, either in the canteen or in a staff dining room. The "business lunch"—entertaining or being entertained—occurs twice a week or less for about 60 per cent.

Only 10 per cent. have never smoked; another 15 per cent. recently gave it up. The rest smoke regularly. Only 30 per cent. admit to smoking even an occasional cigar. Forty per cent. take exercise every day.

Only 16 per cent. of those questioned are directors of four or more companies. More than half are concerned exclusively with one company and its main subsidiaries. Well under 10 per cent. work less than a full day. Some 64 per cent. depend upon experience alone; only 14 per cent. have a university degree.

The investigation is part of a long-term research programme to define the occupational hazards of executive life.

ACCORDING TO THE 1958 REPORT on Netherlands New Guinea, submitted to the United Nations by the Netherlands Government, the Administration of the territory expects that in the near future a start will be made on the mining of proven deposits of nickel, cobalt and iron ores in the Cyclops Mountains and on the island of Waigeo.

# Foundry Trades' Equipment and Supplies Association

## *Annual General Meeting*

The annual general meeting of the Foundry Trades' Equipment and Supplies Association was held on October 27 at the Waldorf Hotel, London, Mr. Gavin C. Paterson presiding. The minutes of the meeting held on October 29, 1958, having been adopted, the balance sheet was presented. The annual report of the Council in respect of the year ended December 31 was then presented and is set out below:—

*Membership*

During the year 1958, seven new members were elected, making a total membership of 88 at December 31; at no time since the formation of the Association in 1925 has this number been exceeded. Nevertheless, the Council is conscious of the fact that there are still a number of companies who have not yet joined and efforts will continue with the object of achieving a membership strength which will be fully representative of the industry.

*Accounts*

The Accounts of the Association for the year ended December 31, 1958, showed an excess of expenditure over income amounting to £4 12s. 11d., and including the balance at December 31, 1957, there was a total deficit of £154 8s. 4d. During both these years, the Association incurred additional expenditure on matters relating to the Foundry Exhibition which amounted to £703 13s. 3d., and this will be recovered from the Exhibition account.

*Council*

Members were informed of the death of Mr. D. H. Wood and of Mr. T. A. Hammersley, both of whom had served for many years on the Council and committees of the Association. During the year, eight meetings of the Council were held and when necessary members have been kept informed of events.

*Election of President and Council*

A number of members submitted proposals on this matter and subsequently an extraordinary general meeting was held on September 2, 1958, at which a new bye-law was ratified to supersede the previous bye-law dated September 13, 1945. This has the effect of creating a vacancy on the Council every one or two years by reason of the fact that retiring presidents now become ex-officio members of the Council for specified periods.

*Clean Air Act, 1956*

As the result of this Act, the ironfoundry industry in particular was presented with a number of difficult problems relating to atmospheric pollution from cupolas. Following discussions between interested members of the Association and the Council of Ironfoundry Associations, a joint meeting was held with national organizations of local Governments in an endeavour to obtain some uniformity of approach to the problems which had to be overcome.

*Anti-dumping Duty Committee*

This committee was formed following an application being made to the Board of Trade for the imposition of an anti-dumping duty on maize and milo starch imported from the Netherlands. A protest against this was made by the Association. Subsequently the Board of Trade decided that a case for imposing such a duty had not been made out.

*Foundry Exhibition*

The exhibition committee continued to meet at frequent intervals to consider the matters relating to the Foundry Exhibition, sponsored by the Association, which took place at Bingley Hall, Birmingham, in May, 1959. The Council wishes to record its appreciation of the work of the committee, the members of which have contributed so much of their valuable time on this successful project. Also, the members wish to pay a warm tribute to Mr. Barrington Hooper for his help and guidance, and for providing without cost to the Association 2,000 spiral-bound copies of the special issue and catalogue published by the FOUNDRY TRADE JOURNAL which were sold at the Exhibition.

*Association Handbook*

Over 900 copies of the third edition of the "British Foundry Plant and Supplies Handbook" were despatched to foundries overseas and to UK embassies throughout the world.

*Borough Polytechnic*

Mr. Gavin C. Paterson was nominated as the Association's representative to serve on the foundry advisory committee of the Borough Polytechnic.

*University of Birmingham*

Members of the Association responded to an appeal issued by the University for the loan of certain foundry equipment required in connection with their new graduate course in foundry science and engineering.

*Institute of British Foundrymen*

Members of the Association contributed a total of £384 1s. 0d., towards the expenses of the 1958 conference of the Institute of British Foundrymen.

*National Union of Manufacturers*

Mr. C. Orton Foster was appointed as the Association's representative to serve on the Executive Council of the National Union of Manufacturers.

*Association Dinner*

The Council wishes to record its appreciation of the work of the dinner committee which resulted in a very successful dinner at the Savoy Hotel. From the excellent attendance of members and their guests, it is now clearly apparent that this has become an annual event.

### Further Proceedings

After the formal business had been transacted, the meeting decided in principle that the next exhibition would be held, as a national exhibition, in 1963 in Birmingham. The profit on this year's Exhibition is to be placed to the credit of a trust fund to be available for financing the next one. The members unanimously agreed to raising the annual subscription to £21, as for some years losses had been incurred on operating the Association. From Mr. J. P. P. Jones, of W. J. Hooker & Company, Limited, came a proposition that the members of the Council, especially the exhibition committee, should be accorded the warmest thanks of the general members for the great amount of voluntary work that they had put in to assure the success of the Exhibition. This was warmly endorsed by the meeting. Mr. Frank Webster proposed, and Mr. V. C. Faulkner seconded, a vote of thanks to the chairman and president (Mr. Gavin C. Paterson), for his conduct of the day's meeting, and for the successful work he had put in for the benefit of the Association during his year of office.

At a Council meeting which followed, Mr. Gavin Paterson was re-elected president for a further term of office; Mr. V. L. Cashmore (British Moulding Machine Company, Limited), and Mr. B. N. S. Perry (G. Perry & Sons, Limited) were co-opted to the Council.

## Rapier Walking Dragline for Alberta

Placed with Ransomes & Rapier, Limited, Ipswich, by Calgary Power, Limited, Alberta, an order for a large electrically-driven walking dragline is the first contract for this type of machinery placed in this country for delivery to the North American Continent. Won in the face of fierce American competition, the contract is worth $1,500,000 (approx. £500,000).

The order is for a machine recently introduced into the RapieR range of walking draglines, which are designed specially for open-cast mining operations. Known as the RapieR W1350, the machine weighs 1,400 tons and will be equipped with a 33-cub. yd. bucket capable of carrying 50 tons of material at a time at a radius of 215 ft.

After being manufactured at Ipswich, the dragline will be dismantled into suitable units and shipped to Canada *via* Vancouver and then taken through the Rockies by rail to the assembly area at Wabamun, near Edmonton. It is expected to be working by the middle of 1962 and will be used for removing overburden on top of 750,000 tons of coal required each year for power stations in the vicinity.

The very low temperatures in which the dragline must work in the winter—82 deg. of frost has been recorded in the area where the machine will be working—sets many interesting problems of design and construction. Special steels will be used to meet the conditions.

## Eighth SIMA Convention

The Eighth Annual Convention of the Scientific Instrument Manufacturers' Association, organized by a committee under the chairmanship of Mr. W. A. Jones, Fleming Radio (Developments), Limited, took place at the Hotel Metropole, Brighton, on October 22 to 24, under the presidency of Mr. L. A. Woodhead, Cossor Instruments, Limited. There was a record attendance of members, over 70 firms taking part, and a number of distinguished visitors also attended.

The theme of the Convention was "Instruments of Destiny" and the subjects were dealt with by four panels under the headings of "Instruments of the Future," "Future Materials and Production Techniques," "Organizing for the Future," and "The Individual and the Company." The discussions covered the Nuclear Age, the Space Age, and the conditions, technology, instruments and components that would be needed in the future, including such purposes as ballistic missiles, and satellites. The organizational, marketing and financial needs of the forward-looking company were covered, and a number of subjects from the aspect of the individual in regard to such things as health, financial rewards, pensions, etc., were dealt with.

In addition a number of social events were fitted in, and an enjoyable reception and dinner/dance at which the Mayor of Brighton, Alderman E. W. Kippin, J.P., was present, was held in the Hotel Metropole.

## Latest Foundry Statistics

*Ironfounding:*—According to figures released by the Council of Ironfoundry Associations there was a total of 124,009 people employed in ironfounding at the week ending August 29, an increase of 1,320 over the figure for August 1. At the end of August last year there were 130,725 workers employed in the industry.

## *Film Reviews*

**Sparkling Performance** (27 min.); **In the Hot Zone** (27 min.); and **In the Rough** (30 min.)—available without charge in 16 mm., sound and colour from the films department, Carborundum Company, Limited, Trafford Park, Manchester 17.

The Carborundum Company, Limited, showed three of their instructional films for industry to the Press in London last week. The first, entitled "Sparkling Performance," dealt with the use of diamond abrasives in industry. A dramatized opening sequence emphasized the enormous value of industrial diamonds to the present-day engineering, stone and glass trades. The second presentation was "In the Hot Zone," which is claimed to be the only film in existence which deals with the subject of industrial heat-control by super-refractory materials. To the layman this will be a real revelation whilst even the furnace or foundry expert will find it highly instructive and of absorbing interest. This film was easily the most spectacular of the trio presented—the grandeur of glowing furnaces and molten metal being exceptionally well portrayed.

Finally came "In the Rough," which proved to be an interesting study of the rôle which has been played by modern abrasives in the development of foundry and other heavy-engineering techniques. This film was at once dramatic and entertaining, the expert photography being backed by a drily-humorous commentary. A seemingly prosaic subject was shown to be, in reality, packed with colour and human interest.

## British Standards Institution

The first part of a new British Standard for investment castings in metal, B.S. 3146:Part 1:1959, recently published by the British Standards Institution, deals with castings made from carbon- and low-alloy steels; further parts to be published later will deal with higher-alloy and special-temperature steels. Castings of the type specified in this new publication are those where manufacture involves the investment of an expendable pattern by refractory slurry; castings by the shell-moulding process are thus excluded from the scope of this standard.

Section one of the standard surveys general requirements and specifies the process of manufacture, the method of identification of the casting, the procedure for testing both mechanically and by destructive methods and the arrangement necessary for repairing castings. Section two provides specific requirements for 12 different types of casting, many of which are sub-divided into two or three grades. The chemical composition and mechanical properties of each type of casting are detailed.

Copies of this standard may be obtained from the British Standards Institution, sales branch, 2, Park Street, London, W.1; price 6s. (Postage will be charged extra to non-subscribers.)

The Institution also announces that a draft standard A (SFE) 1364 for Simplified Methods for Measurement of Grit and Dust Emission has now been issued for comment, and requests that comments should be submitted not later than February 13, 1960.

### IBF Head Office move to London

The actual transfer of the head office of the Institute of British Foundrymen from Manchester to 14, Pall Mall, London, S.W.1, is to take place over the week-end commencing Friday, November 13, and correspondence to arrive on and after Monday, November 16, should be sent to the new address. The new telephone number is to be WHitehall 7141-2.

*Section devoted to the technology of producing DIMENSIONALLY ACCURATE CASTINGS*

# Properties of Cobalt-base Investment-cast Alloys*

*By M. Riddihough, M.Met., A.R.I.C., F.I.M.*

**General comments on the early days of investment casting are made first. These are followed by a detailed description of the mechanical properties of the cobalt-base alloy X40. The final section is devoted to abrasion-resistant cobalt alloys, and the difficulties of assessing wear resistance.**

In its early days the investment-casting process was used to produce single pieces of statuary in expensive alloys, and its adoption by the dental, surgical and jewellery professions during the present century has led to quantity production, still in expensive metals. However, it was the development of the casting of gas-turbine blades in large quantities which brought the process into the engineering field to such an extent that the cheapest metals are now handled economically by investment casting, when circumstances warrant. Since the engineering process was developed using a particular class of alloy, *i.e.*, the cobalt-base metals for high-temperature use, this section will be covered first.

TABLE 1.—*Percentage Compositions of Various High-temperature Cobalt-base Alloys.*

| — | C. | W. | Mo. | Cr. | Ni. | Fe. | Si. | Mn. |
|---|---|---|---|---|---|---|---|---|
| Vitallium AMS 5385 .. / Stellite 8 or 21.. .. | 0.2/0.3 | — | 5/6 | 25/29 | 1.75/3.75 | 3 max. | 1 max. | 1 max. |
| Stellite 7 or 23 .. / AMS 5375 .. .. | 0.35/0.45 | 4/6 | 1 max. | 23/27 | 0.5/3 | 2 max. | 1max. | 1 max. |
| X-40 Stellite 31 .. / AMS 5382 .. .. | 0.45/0.55 | 7/8 | — | 24.5/26.5 | 9.50/11.5 | 2 max. | 1 max. | 1 max. |
| X-40 (see Figs. 1-3) .. .. | 0.47 | 7.26 | — | 25.52 | 10.96 | 0.45 | 0.35 | 0.25 |
| X-40 (see Table 2) .. .. | 0.49/0.51 | 7.0/7.3 | — | 24.2/25.2 | 10.4/12.6 | 0.81/1.1 | 0.54/0.63 | 0.08/0.14 |

## Work done by Rolls-Royce

When Rolls-Royce, Limited, took over the production of gas turbines during hostilities, they decided to use the investment-casting process for the production of nozzle guide-vanes, in view of the successful use of this process in the USA, on a similar project, *i.e.*, the Boeing exhaust supercharger buckets. The manager of the Rolls-Royce foundry in Glasgow, Mr. John Vickers, went to America to obtain details of the Austenal process, and on his return he demanded a supply of cobalt-base alloy ingot, then known as Vitallium, for recasting. This alloy is of course virtually the same as the one which is used by the surgeons for implants in the human body, and by the dentists for denture plates. The present-day specification of this alloy is "Stellite" 8 in England, 21 in the USA, and is shown in Table 1. The addition of nickel was made to reduce ageing embrittlement, as in the USA a large proportion of the alloy was used in rotor blades, whereas in the UK the alloy

TABLE 2.—*Stress-rupture versus Temperature Figures for Four Casts of X40 Material.*

| Cast. | Temperature of test. | Load (tons/sq. in.) to produce rupture in | | | | |
|---|---|---|---|---|---|---|
| | | 100 hr. | 300 hr. | 500 hr. | 750 hr. | 1,000 hr. |
| A | 700 deg. C. | 21.5 | 19.4 | 18.4 | 17.5 | 17.0 |
| B | 800 deg. C. | 13.6 | 11.8 | 11.0 | 10 1 | 9.7 |
| C | 900 deg. C. | 7.5 | 6 3 | 5.9 | 5 3 | 5.0 |
| D | 950 deg. C. | 6.5 | 5.0 | 4.2 | 3.8 | 3.2 |

(*Courtesy: Bristol Aero-Engines, Limited*)

* Another instalment of the series of papers presented at the first annual conference of the British Investment Casters' Technical Association (held at Connaught Rooms, London, on May 11 and 12). The author is on the staff of Deloro Stellite Limited, Shirley, Solihull, Warwickshire.

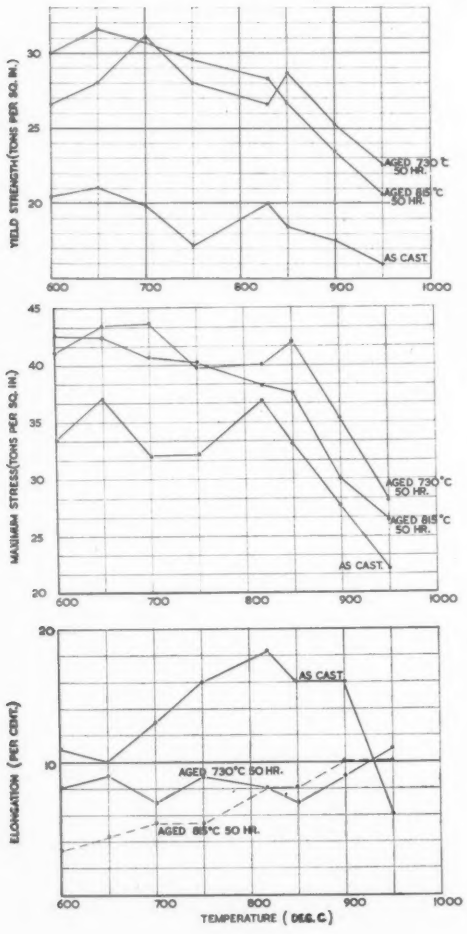
has been confined to nozzle guide-vanes. At the end of hostilities, Rolls-Royce found that adequate properties for their engine were obtained from lower-alloy material, and they changed to HR Crown Max. However, subsequent engine development has called for higher temperatures and stresses, and in recent years cobalt-base alloys have again come into favour with some engine manufacturers.

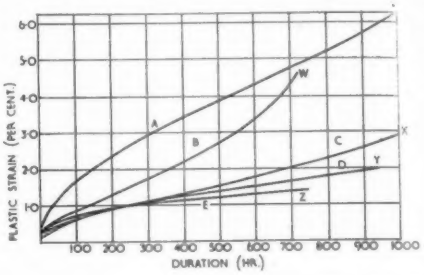
### Recent Developments

An alloy which was originally used quite extensively is a variation known as "Stellite" 7 (see Table I), in which molybdenum is replaced with tungsten. However, in the last few years X 40 has come to the fore, and it is now the only cobalt-base alloy used to a large extent. Besides good high-temperature properties and resistance to thermal shock it has excellent casting qualities, and is often used in the production of castings which are difficult to make in other types of high-temperature alloy. In giving this paper the Author's aim has been to present typical properties of X-40 as found on production. He has been able to draw on information kindly provided by the engine firms, to whom acknowledgment is made for the illustrations.

FIG. 1.—*Mechanical properties of the cobalt-base alloy X40.*

(*Courtesy: D. Napier & Sons, Limited*)



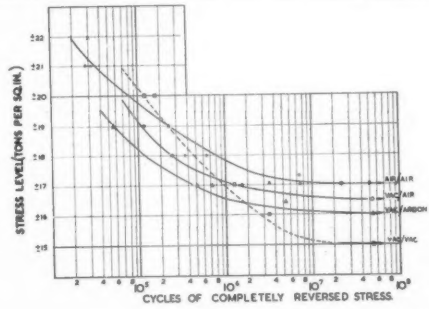




(*Courtesy: D. Napier & Sons, Limited*)

FIG. 2.—*Short-term creep properties of Deloro X40 alloy (DNS 216), air melted, air cast, aged 50 hr. at 815 deg. C.*

A—13 tons per sq. in., 750 deg. C.
B—23 ,, ,, ,, 650 ,,
C—20 ,, ,, ,, 650 ,,
D—15 ,, ,, ,, 700 ,,
E— 8 ,, ,, ,, 815 ,,

V—Rupture at 1,031 hr., 6.45 per cent
W— ,, 718 ,, 4.66 ,, ,,
X— ,, 1,489 ,, 5.64 ,, ,,
Y— ,, 935 ,, 1.94 ,, ,,
Z— ,, 746 ,, 1.44 ,, ,,




(*Courtesy: D. Napier & Sons, Limited*)

FIG. 3.—*Limiting fatigue stress, at a test temperature of 850 deg. C., of X40 alloy (aged 25 hr. at 815 deg. C.).*

## TYPICAL PROPERTIES OF ALLOY X40

### Percentage Composition

The specification in Table I is a relatively wide one, which can be held without difficulty in practice with either high-frequency or arc-melting in the

investment foundry. Ingot for arc-melting is usually of lower carbon content, to allow for a little pick-up during re-cycling, and the only other element which may vary is the iron content if there is any contamination due to shotblasting. Providing the metal is not overheated above 1,600 deg. C. it does not become dirty in melting, and it can be re-cycled if adequate control is kept on carbon and general analysis.

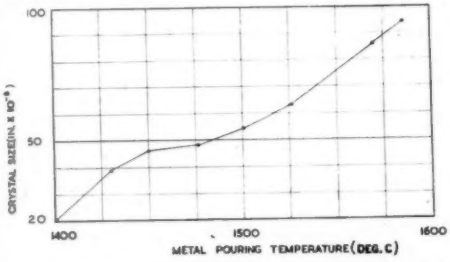
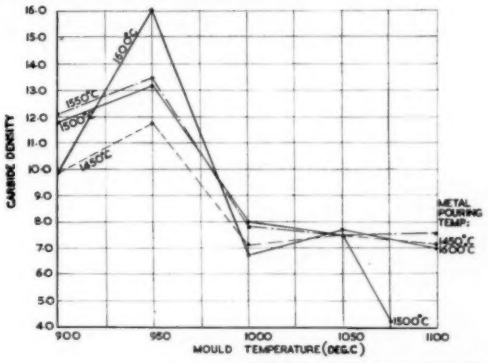



FIG. 4.—*Graph of crystal size* versus *pouring temperature, for a cobalt-alloy* (*Stellite* 6) *casting of* ½*-in. square section by* 3½ *in. long, made in a sand mould.*

### Tensile Strength

Fig. 1 illustrates the tensile strength (cold and hot), and the effects of ageing. A considerable improvement in yield strength is given by ageing, and this remains effective at temperatures higher than that used for ageing. A useful point is that ageing gives more uniform ductility at high temperature, and even improves the ductility at 950 deg. C. The composition of the metal used for the test-bars is shown in Table I.

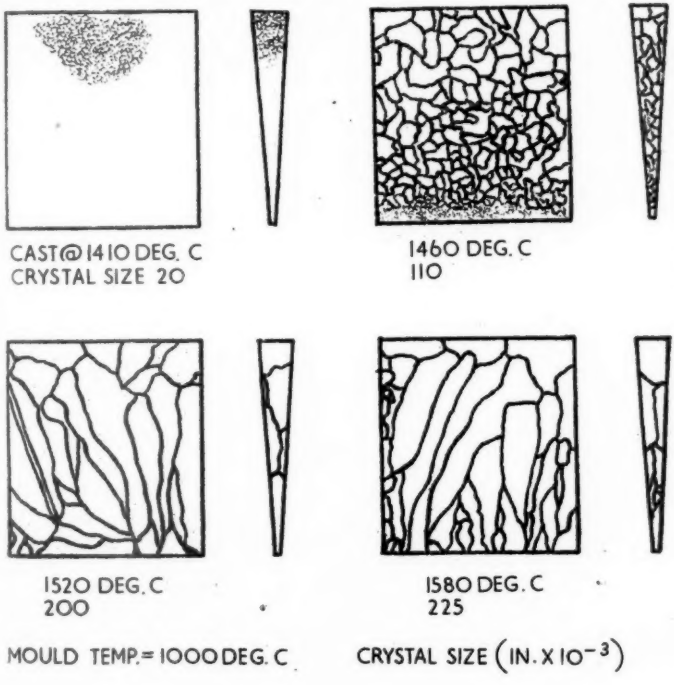



*(Courtesy: Bristol Aero Engines, Limited)*

FIG. 6.—*Graph of carbide density* versus *mould temperature, for a series of test castings of X*40 *alloy.*

### Stress Rupture and Short-time Creep

Investigations of stress-rupture performance by three different companies show a good level of agreement, as illustrated in Tables 2 and 3 and Fig. 2. As a test of the uniformity of results obtained in production a series of investment melts was made at five different metal-pouring temperatures, and four mould temperatures from 950 to 1,100 deg. C., *i.e.*, a total of 20 melts. A stress-rupture bar was made with each melt and tested at 900 deg. C. and 9 tons per sq. in. In the 20 results obtained the minimum time to rupture was 24 hr. and the maximum 106 hr., with an average of 46.3 hr.




### Fatigue

The limiting fatigue-stress at temperature is illustrated in Fig. 3, from which it appears that vacuum-melting or casting does not improve the fatigue properties at high temperature.

### Cast Structure

The crystal size obtained in a

FIG. 5.—*Relationship of crystal size to pouring temperature, for a "dummy" blade investment-cast in X*40 *material.*

*Cobalt-base Investment Alloys*

given casting depends on the pouring temperature of the metal and the temperature of the mould. This relationship is relatively easy to prove on a laboratory scale, and Fig. 4 shows typical results obtained on a cobalt-alloy casting ½ in. square by 3½ in. made in sand. Similarly, a dummy b'ade investment-cast in X-40 gives the relationship of crystal size according to casting temperature shown in Fig. 5. However, such a close correlation is not easy to find in practice when casting a batch of blades in an investment mould. A large amount of metal is poured into a mould down a central runner, and as the mould tilts some blades are downpoured and others bottom-poured[1]. There is a wide variation in method of entry of molten metal into each cavity, and probably a wide variation in individual metal temperatures even though the metal was poured at the one temperature.

TABLE 3.—*Further Stress-rupture* versus *Temperature Figures for X40 Metal.*

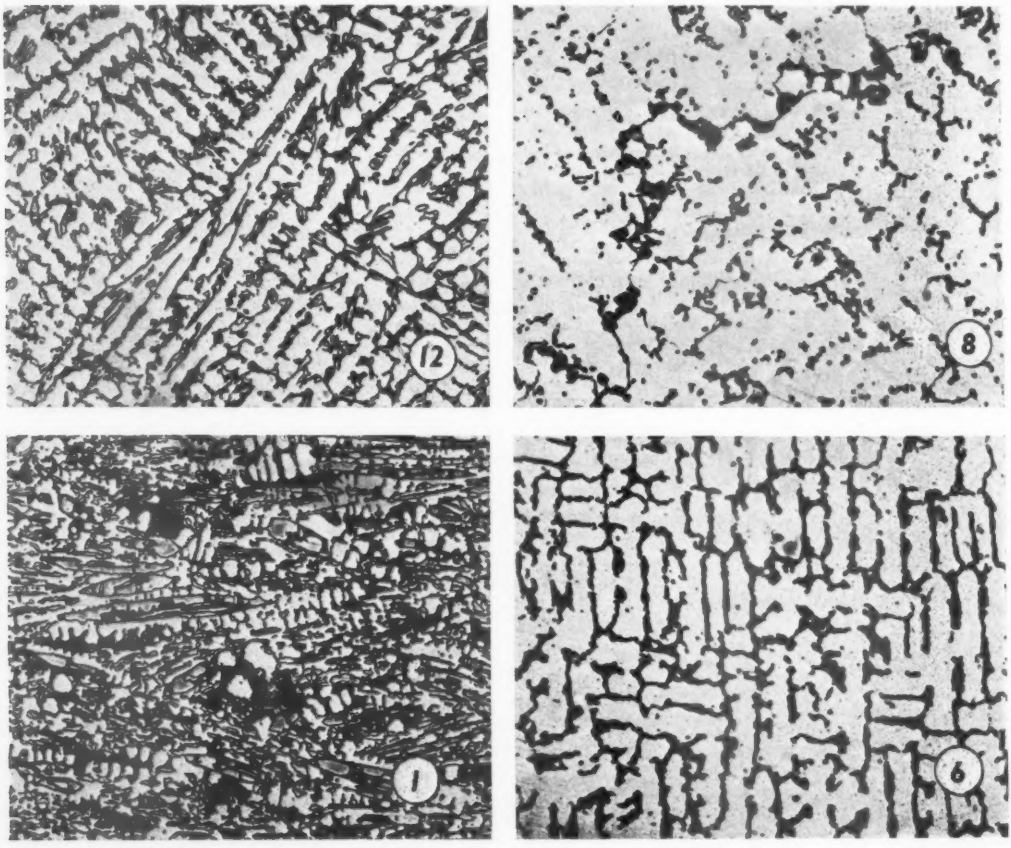
| Temperature of test. | Load (tons per sq. in.) to produce rupture in | | |
|---|---|---|---|
| | 30 hr. | 100 hr. | 300 hr. |
| 700 deg. C. .. .. .. | 24—26 | 19—24 | 18—22 |
| 750 deg. C. .. .. .. | 18—20 | 16—19 | 14—17 |
| 800 deg. C. .. .. .. | 13—16 | 11—14 | 10—13 |
| 850 deg. C. .. .. .. | 10—13 | 9—12 | 8—10.5 |
| 900 deg. C. .. .. .. | 8—10 | 7—9 | 6—8 |

(*Courtesy: de Havilland Engine Company Limited*)

TABLE 4.—*Percentage Compositions and Hardnesses of Standard Wear-resisting Cobalt-base Alloys.*

| Grade. | Hardness. | | Composition (per cent). | | | | |
|---|---|---|---|---|---|---|---|
| | Diamond Pyramid. | Rockwell "C." | C. | W. | Mo. | Cr. | Co. |
| 1 .. | 600 | 54 | 2.5 | 13 | — | 33 | 50 |
| 12 .. | 500 | 48 | 1.8 | 9 | — | 29 | 58 |
| 6 .. | 400 | 40 | 1.0 | 5 | — | 26 | 65 |
| 8 or 21.. | 325 | 33 | 0.25 | — | 6 | 30 | 62 |

FIG. 7.—*Carbide structures of the alloys listed in Table* 4, *where the respective hardnesses are quoted* (*grade numbers in circles*).



*Relationship between Carbide Density and Mould Temperature*

As an illustration of this, tests were carried out by one engine company in which a series of moulds were poured at five different mould temperatures and four different pouring temperatures, *i.e* a total of 20 melts. The investigations included

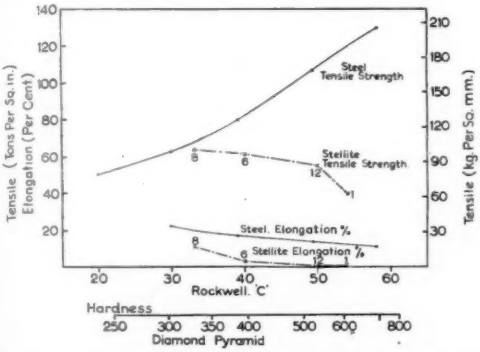



FIG. 8.—*Graph comparing the tensile strengths in tons per sq. in., and elongations per cent. (at 20 deg. C.), of steel and Stellite at various hardnesses.*

analysis, stress-rupture tests, elongation, grain-size counts and determination of the carbide density. No relationship was apparent between the stress rupture, elongation and grain-size, and the metal or mould temperature. However, a relationship was evident between the carbide density and the mould temperature, as shown in Fig. 6. The author's own experience of general foundry prac-

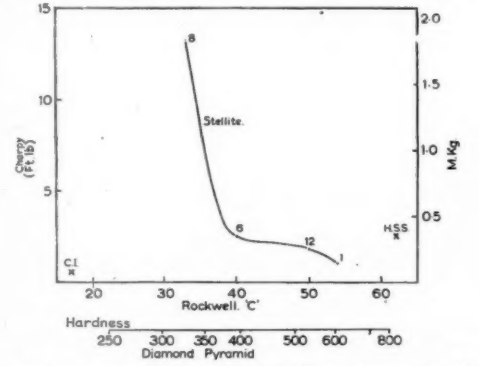



FIG. 9.—*Impact strength of Stellite (charpy (ft. lb. or M. Kg.), "V" notch at 20 deg. C.), compared with points for cast-iron and high-speed steel.*

tice with cobalt-base alloys is that a controlled uniform grain-size and carbide density throughout the casting is conducive to better corrosion resistance and thermal shock resistance. Dr. N. Grant[2] went even further, and claimed a close correlation between grain-size and rupture life.

The author makes no apology for dwelling at some length on high-temperature alloys, because the lessons learnt from them are applicable to other metals, and also because there is a growing field for their use in commercial high-temperature components such as super-charger rotors and small commercial gas-turbine rotors.

## ABRASION-RESISTANT COBALT-BASE ALLOYS

The second half of this paper is concerned with cobalt alloys used for abrasion resistance. In many instances abrasion is accelerated by corrosion and heat, and the author now tries to compare the cobalt alloys with the normal commercial steels to get them into perspective. Table 4 illustrates the composition and hardness of the alloys which have been standardized for many years. The high-carbon and high-tungsten composition (grade 1) contains most carbide in the micro-structure, as shown in Fig. 7, and in general has the greatest wear resistance. Naturally, the greater hardness is accompanied by less ductility and, contrary to steel, the tensile strength also diminishes, as shown in Fig. 8. This means that whilst the softer grades 8 and 6 have very good strength (of the order of 55 tons per sq. in. as cast), the harder grades must be supported if subject to heavy load. For instance, extrusion dies of cast cobalt alloy are supported in a tool-steel bolster hardened to 90 to 100 tons per sq. in. The impact strength at room temperature is adequate, as shown in Fig. 9, and the hard grade-1 alloy is still less brittle than good quality cast-iron. Fig. 10 indicates that a grade can usually be chosen that has an equivalent corrosion resistance to that of stainless-steel.

### Assessing Wear Resistance

Wear resistance is not a property which can easily be assessed. Many tests have been done to copy service conditions, but it is still only possible to estimate wear under a set of new conditions by comparing past experiences. However, as the cobalt alloys are resistant to all three factors which bring about wear, *i.e.* heat, corrosion and indentation, they fill a field where resistance to two or more of the above conditions is required, in contrast to structural metals (such as stainless-steel and cast-iron) which are used for simple corrosion or abrasion resistance.

All the data which have been given apply to the alloys in the as-cast condition. No subsequent heat-treatment is carried out, although prolonged heating at 800 to 1,000 deg. C. causes age-hardening to the extent of up to 10 per cent. of the original hardness. The alloys are not softened by an annealing treatment or heating to any temperature below the melting point, and it has not been found that stress-relieving treatment is normally necessary for investment castings.

## CONCLUSION

In conclusion, it is suggested that investment founders remove some of the remaining variables in their processes, by controlling the method and

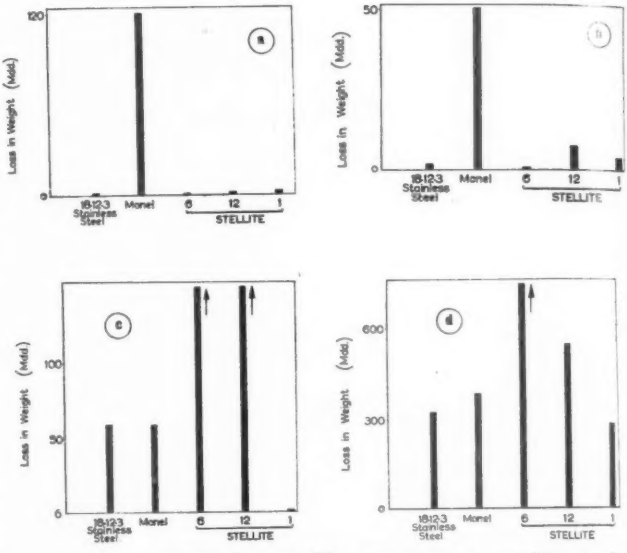



FIG. 10.—*Comparison of the corrosion resistance of Stellite, Monel and stainless-steel to* (a) 20 *per cent. nitric acid;* (b) 20 *per cent. acetic acid;* (c) 30 *per cent. sulphuric acid, and* (d) 20 *per cent. hydrochloric acid.*

rate of flow of the metal into the individual mould cavities, in the same manner that mould- and metal-temperatures are controlled.

## DISCUSSION

Following the presentation of Mr. Riddihough's paper, the CHAIRMAN, Mr. G. A. Tomkinson (D. Napier & Son, Limited), said that it seemed to him that there were some materials which could be air cast, despite Mr. D. R. Wood's warning, in his paper, that vacuum melting and vacuum casting would have to be used eventually.

### Hot Moulds, or Cold?

MR. WALKER (Hadfields, Limited), said that work done by Bristol Aeroplane Company, Limited, on mould temperature, had given a range of 900 to 1,100 deg. C.; and asked if any work had been carried out on lower mould temperatures, and if there was any virtue in attempting mould temperatures of, say, 600 or 700 deg. C. with these alloys.

MR. RIDDIHOUGH replied that it was always better to get moulds as cold as possible, because that would result in a smaller grain-size, as well as smaller dendrite size, in the casting. If there was too much chill (referring to room temperature and even to chilled moulds), then there was a variation over the cross-section of the casting because of the very high rates of cooling. The shell moulding process gave a very even grain-size, but the cooling rate compared with ordinary sand casting was slowed down by what was, presumably, a gas film. However, the cooling rate was not as slow as in an investment mould heated to, say, 500 or 600 deg. C.

MR. J. HENDRY (Preformations, Limited) then said that his firm was one of the only remaining concerns still casting Vitallium or Stellite 8, and that they periodically ran into the question of carbide segregation. With regard to Fig. 6, in Mr. Riddihough's paper, in their experience the opposite was true regarding mould temperature and carbide density. When keeping their mould temperature to a minimum and maintaining high melting temperature, they seemed to have less trouble.

MR. RIDDIHOUGH said here that his firm measured the distance apart of the arms of the dendrite by using a graticule on the microscope, and varied the magnification until the structure matched the graticule, so obtaining a measure of the dendrite spacing. It was this structure which was sensitive to mould temperature. With a chill mould an extremely fine carbide spacing was obtained; with a very hot mould, a very coarse carbide spacing was obtained. Mr. Hendry's problem might, however, be a rather different one, which was still being investigated at Mr. Riddihough's firm.

MR. A. DUNLOP (W. J. Hooker, Limited) then stated that, regarding Mr. Riddihough's reference to the use of a cold mould, he thought it was one of the secrets of sound investment-casting to use a hot mould, which contributed something to the feeding of the castings which was not obtained in sand moulds. Mr. Dunlop then asked whether Mr. Riddihough had investigated any other method of grain control, such as inoculation, and said that it was quite common practice in light alloys and, to some extent, it had also been done on iron-base alloys of the HR Crown max type. It was possible to treat the mould surface with an inoculant which would refine the grain, and to cast at the same high temperature and obtain a very fine grain size, he concluded.

MR. RIDDIHOUGH answered by saying that his firm had indeed carried out experiments on inoculation with a very fine powder, and had had some success using aluminium painted on to the mould surface, but it did not seem to extend right through a casting about half an inch thick. It had had some effect, but not enough to warrant them persisting with the process. Mr. Riddihough continued that he did not agree with the view that the hot mould was necessary for making sound castings, because all the standard BS test-pieces of four times the square root area, or 5.6 times the square root area, could be cast in cobalt-base alloys at room temperature to give a perfectly sound casting in ordinary types of sand mould.

MR. DUNLOP then said that that view referred only to a simple casting, and that, when making a complicated casting, distortion or cracking were often obviated by the use of a hot mould. Turbine

blades with thick and thin aerofoil sections would be distorted if cast in a cold mould, he added.

MR. RIDDIHOUGH replied that, for really complicated shapes, temperatures of 800 or 900 deg. C. were needed in any case.

### Any Correlation between Carbide Density and Mould Temperature?

MR. R. TAYLOR (Firth-Vickers Stainless Steels, Limited) entered the discussion at this point, by saying that he was very puzzled and intrigued by Fig. 6 in the paper. Since he first saw this graph, he had been repeatedly looking at it, and there was only one way in which he thought one could try to interpret it, and that was in terms of heat content, conductivity, diffusivity and so on. It would appear, he said, that above a mould temperature of 1,000 deg. C., with one exception, all these readings were very much the same, between 7 and 8 carbide density, and that was irrespective of metal pouring temperature, which varied over a range of 100 deg. C. From this part of the graph, it appeared not to matter what the mould temperature was, or what the metal temperature was, one was going to get the same carbide density anyway, which was an ideal state of affairs if 7 to 8 was the carbide density one wanted. However, if one wanted to increase the carbide density, and, to achieve this, lowered the mould temperature, there was a peak at 950 deg. C.

Mr. Taylor continued that he thought these results were very "statistical" indeed, and might be due to the randomness of the basic data. For instance, it was highly probable that there was a very poor correlation between the actual metal structure examined and the temperature reading taken. He assumed that there was a platinum/platinum/rhodium thermocouple buried in the mould; and that it was a reading obtained from only one spot.

Thinking in terms of heat-content effects, he said, a statistician would re-draw the graph in question. However, assuming that the four peak figures at 950 deg. C. were really statistically significant and, in fact, there was a peak there, how could one reconcile that in terms of heat content? There was less heat in a mould at 900 deg. C. than in one at 950 deg. C., and if the more rapid chilling effected by a mould at 950 deg. C. increased the carbide density relative to conditions produced by a mould at 1,000 deg. C. or over, it was to be expected that an even cooler mould would have at least the same effect. Mr. Taylor then said that he could, in his own mind, find an explanation for the relative stability of the results obtained at varying metal-pouring temperatures with mould temperatures at 1,000 deg. C. and hotter. He suggested that, under those conditions, there occurred, during the first split second of metal/mould-cavity contact (the mould material being comparatively insulating and of low thermal conductivity and diffusivity, relative to metal), a heat-saturation effect of the skin of the mould cavity with the result that, for a significant time, there existed what one might call a state of thermal stagnation or near-equilibrium, in terms of rate of heat dissipation from the cast metal to the mould. For example, a mould temperature of 1,000 deg. C. and over was sufficiently near to the metal freezing temperature for the actual heat-content of the metal to be comparatively unimportant because the skin of the mould cavity extremely rapidly reached the adjacent metal temperature, and variations in cooling conditions were, to a large extent, ironed out.

Below 1,000 deg. C., however, there was apparently a threshold value of heat-extraction by the mould, which gave that significantly increased chill to have an effect in terms of increasing the carbide density. He could not, however, see why going progressively below 1,000 deg. C. mould temperature one should not get, perhaps parabolic-wise, an increase of benefit in terms of carbide density rather than a peak at some arbitrary temperature in between. Similarly, if the data were reliable and accurate enough, he would expect some (at least statistical) indication that, at lower metal pouring temperatures, the results were increasingly better, *i.e.* higher carbide densities as the pouring temperature decreased. Fig. 6, if anything, hinted at the opposite of this. In trying to interpret the graph statistically in terms of heat content effects, he thought it was full of contradictions, and wondered if Bristol, who did this work, had themselves found any logical explanation for these apparently contradictory data.

MR. RIDDIHOUGH answered by saying that he quite agreed that that graph was difficult to explain, and that all he had put it in for really was to point out that there was some correlation between carbide density and mould temperature. If one re-plotted the same figures in a number of ways one could not really get any correlation the other way round, *i.e.* between metal pouring temperature and carbide density. In fact, as was stated in the paper, Bristol had tried to find some analogy with stress rupture, elongation and grain-size as well, but nothing had come out of the investigation except the carbide density relationship, and even that could not be correlated with the hot stress rupture and hot elongation.

MR. R. TAYLOR then asked whether it had, in fact, been found advantageous to employ a mould temperature of 950 deg. C. with the benefit of an apparent optimum carbide density at that level.

MR. RIDDIHOUGH replied that no thermal shock tests had been done in that series of tests, and that his firm had not done anything of that nature on thermal shock tests. They had done thermal shock tests *vis-a-vis* alloys, but not particularly for the different states of one alloy.

### Cobalt-base Alloys to rival Nickel-base?

MR. A. G. MASON (Deritend Precision Castings, Limited) now asked whether any research work was taking place to produce cobalt-base alloys which would rival nickel-base alloys?

MR. RIDDIHOUGH said that work was in progress in the US, both privately, and also by the newly formed Cobalt Development Association. They seemed to be working with a variant of X40, in which the tungsten content had been increased from 5 to 15 per cent., and with an addition of boron to increase the high-temperature strength. Unfortunately, the elongation in such a case went down,

*Cobalt-base Investment Alloys*

and they were trying at the moment to achieve a balance of elongation and stress-rupture life.

MR. H. PLUMMER (Ministry of Supply) ended the discussion by saying that the US approach to the development of high-temperature alloys for gas-turbine applications was somewhat different to that in England. The UK was interested more in the nickel-base alloys, because although there might be little to choose between secondary creep rates of the respective alloys, the primary creep rates of the nickel alloys were not as great as those of the cobalt-base alloys. American turbine-blade tip clearances were larger than those of British engines, and cobalt-base alloys could be used for blades in the States which would not give a satisfactory performance in British engines. It was unwise, he concluded, to compare creep behaviour of cobalt- and nickel-base alloys on the basis of stress-rupture data.

REFERENCES

[1] "Pouring of Investment Castings," M. Riddihough, FOUNDRY TRADE JOURNAL, June 20, 1957, **102**, 761 and 762.

[2] "Influence of Metal Structure on Properties of Investment Castings," Dr. Nicholas J. Grant, *Precision Metal Moulding*, September, 1954, 122 to 126.

**Introducing the Author**

Mr. M. Riddihough was educated at King Henry VIII School, Coventry, and apprenticed in the metallurgical laboratory of W. H. Allen Sons & Company, Limited, Bedford. He graduated at Sheffield University and joined Deloro Stellite, Limited, in 1933, where he was appointed technical manager in 1942. His interests are the production and industrial use of cobalt alloys, and he is the author of "Hardfacing by Welding" and numerous papers. He is chairman of the Institute of Welding, Birmingham Branch.

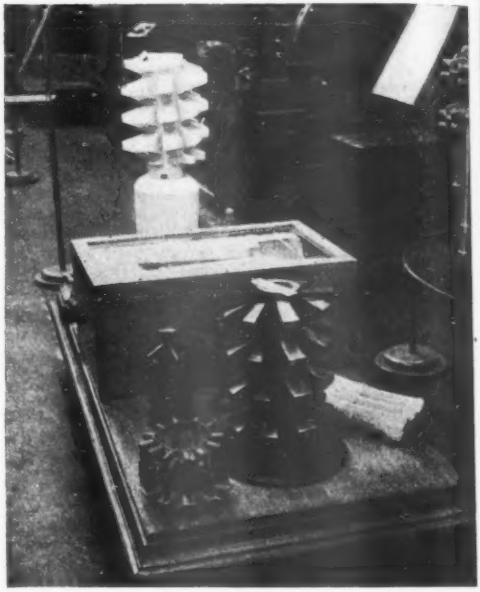
## European Investment Casters Conference

Since 1955, a number of annual conferences on investment casting have been organized in Europe and most of the members of the European investment casting industry have participated in these. Undoubtedly, every participant feels the desirability of continuing these conferences, dedicated to further the advancement of the investment casting industry, to bring personal contacts and understanding, and exchange of ideas between colleagues.

At the last congress held in Essen (reported in this JOURNAL September 3) a small committee was formed to organize future congresses and to give to the European Investment Casters Conference (EICC) a more definite form. To cover the costs of circulars, preprints, out-of-pocket expenses and the printing of the Essen proceedings, it has been decided to request from each participating firm a contribution of £15 (or its equivalent in other currencies) to be paid to Mr. B. J. Helders, the treasurer, "De Industrie" Vaassen. In future, the conference fee will include the cost of a copy of the "Proceedings." The next congress is to be held in Liège, Belgium, from July 4 to July 6, 1960.

## Russian Investment Castings

Russia has shown by a display at the Agricultural and Industrial Exhibition in Moscow—photographed here—that the "lost-wax" method of moulding metal shapes is well taken up. The wax pattern of a crusher wheel can be seen at the far-end of the table. In the wooden box is a cross-section of a mould the Russians would use in making the part, and in the foreground is a finished casting. Other items displayed that the Russians say they make in this way include turbine-blades (left, foreground) for both jet engines for aircraft, and stationary power turbines.



*Russian investment castings and moulding equipment on show at the Agricultural and Industrial Exhibition held recently in Moscow.*

## National Society of Master Patternmakers

A visit to the Production Engineering Research Association at Melton Mowbray, Leicestershire, has been arranged for members of the National Society of Master Patternmakers to take place on Tuesday, November 24. The visit, which will be preceded by luncheon at 12 for 12.30 p.m., at the Bell Hotel, Melton Mowbray, will commence with a short film showing the development of the Association, and examples of research work in industry; the film will be followed by a tour of the workshops and laboratories. The number of visitors will be strictly limited to 36, and those wishing to participate in either the luncheon, the works visits, or both, should make application as early as possible before November 12.

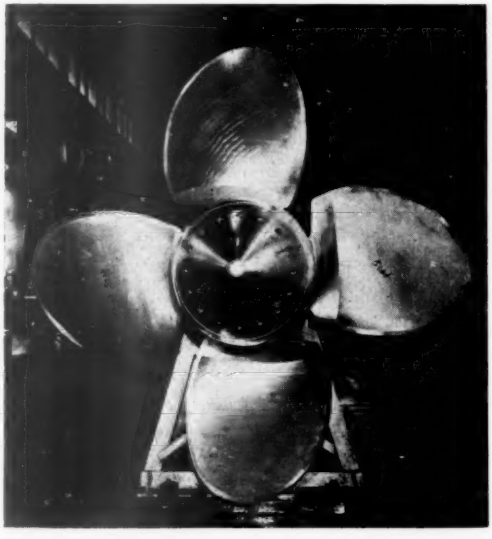
# American Letter

### US Navy's Largest Controllable-pitch Propeller

A new type of balanced-load controllable-pitch propeller, available in diameters of up to 28 ft. and in three different alloys—Nialite (a nickel/aluminium-bronze specification), manganese-bronze and stainless steel—has been developed and patented by Baldwin-Lima-Hamilton Corporation, Eddystone, Pa. It is adaptable to commercial vessels ranging in size from tugboat to super-tanker. The prototype—a reversible, four-blade unit, 9 ft. 9 in. dia., weighing 8½ tons—is the largest controllable-pitch propeller now in service with the US Navy, and its performance has proved superior to that of fixed-pitch propellers.

Navy tests (on the USS Graham County, a 422-ft. landing ship) have proved that variations in propeller pitch allow the engines to develop 100-per cent. mean effective pressure at any engine speed. In addition, the ship was able to stop dead from full speed ahead within a distance of two ship lengths. The new propeller is designed to satisfy the increasing requirements of high-horsepower engines, its control system being completely hydraulic. A four-way control valve and the servo-motor are located in the hub, the valve directing hydraulic oil, supplied by a rotary vane pump, to the appropriate side of the servo-motor which turns the blades for pitch changes. When the desired pitch is reached, the valve shuts off the flow of hydraulic oil. All components of the control circuit, except the master control valves in the engine rooms and pilothouse, are located in the propeller-shaft alley. Each valve in the control circuit is panel mounted for easy accessibility and maintenance. From a design viewpoint, the propeller is best described as a double-crank, single-bearing assembly. "Double-crank" means that on each blade-turning device there are two arms, each applying equal but opposite pressure, to provide a more uniform turning effort than is possible with single-crank or one-arm designs. "Single-bearing" indicates the type of bearing arrangement for holding the blades in the hub, *i.e.*, each of the four blades is threaded into the crankring, which has one journalled diameter.

FIG. 1.—*Controllable-pitch ship's propeller developed by Baldwin-Lima-Hamilton Corporation, Eddystone, Pa.*



# Law Cases

### Moulder Partially Blinded

A claim for damages by a West Bromwich moulder who was blinded in one eye when struck by a fragment of metal at the factory where he worked, was dismissed by Mr. Justice Pilcher at Birmingham Assizes. The plaintiff was Mr. Gerald Fisher (24) and he alleged negligence by Vowles Bros., Limited, West Bromwich grey-iron and aluminium founders.

He claimed that the firm should have provided him with goggles, or some form of protection for his eyes—and that it permitted him to knock off a projection on a casting when his eyes were unprotected.

Giving judgment, Mr. Justice Pilcher said the accident occurred in April, 1957. On the previous day some castings that Mr. Fisher had made had been rejected. He was concerned because he was working on piece rates. He knocked off a "runner" on the casting with a hammer, to check on the constitution of the metal. A piece flew into his eye.

It was virtually universal practice not to provide men involved in "knocking off" with goggles, the judge said. In addition, the risk of injury to the eye was very remote indeed. "Whether the whole work of the foundry would stop if the defendants tried to instruct the men to wear goggles, I don't know, but goggles are certainly unpopular things with moulders and 'knockers off'," he commented.

Costs were also awarded to the defendant firm.

### Factory Fire Compensation

Damages totalling £20,000 were awarded by a settlement at Birmingham Assizes to a Birmingham firm of brassfounders and finishers whose factory was destroyed by fire. Derverlea Products. Limited, claimed damages from Scaffolding (Great Britain), Limited, Bickenhill (Warwickshire), alleging the fire was caused by the negligence of one of its workers. Scaffolding (Great Britain) resisted the action.

Evidence for Derverlea Products was being given when the case was adjourned for a conference by counsel. On their return, Mr. Ralph Brown, QC, for Derverlea Products, announced the terms of the settlement, which Mr. Justice Slade approved.

Mr. Brown, in his opening, said the scaffolding firm was carrying out work at the Clement Street premises of Derverlea Products when one of its employees, carrying a lighted oxy-acetylene torch, went down a ladder. As he did so the flame from the torch set fire to a tarpaulin draped over a window near the fan outlet in the lacquer shop. As a result the factory was destroyed.

By the pleadings, Mr. Brown said, Scaffolding (Great Britain) denied negligence and alleged contributory negligence by Derverlea Products.

### Luton Firm Fined

At Luton (Beds) Magistrates' Court, a Luton firm was fined £150 for 11 offences of allowing drivers to work more than 11 hours a day and eight offences of failing to complete vehicle records. The company pleaded guilty; for them it was said that the drivers who worked longer hours were allowed to take full rest periods.

# Company News

## Mavor & Coulson offers to acquire Austin Hoy

Following the announcement about a month ago that discussions were taking place between two well-known manufacturers of mining machinery and handling equipment, Mavor & Coulson, Limited, Glasgow, and Austin Hoy & Company (Holdings), Limited, Saunderton, near High Wycombe (Bucks), it is now learned that Mavor & Coulson has offered to acquire the £250,000 capital of Austin Hoy on a share exchange of three Mavor & Coulson ordinary shares of 10s. for every four Austin Hoy 5s. shares. It is considered that the merger will lead to greater efficiency in operation, particularly in view of the likely contraction in the coal-mining industry.

The Glasgow firm, which states that no additional capital will require to be created for the transaction, reports that 1959 profits to date are substantially down as forecast, but, subject to unforeseen circumstances, it is intended to maintain the final dividend at 5 per cent. on the capital as increased pursuant to the offer.

Group net assets at December 31, 1958, excluding provision for deferment of tax, amounted to £3,327,515, while those of Austin Hoy at October 31, 1958, totalled £364,269. The Buckinghamshire company's earnings for 1958-59 will also be down and shareholders are told that the yield from the expected final distribution from their Mavor & Coulson shareholding is likely to be more advantageous than would have been forthcoming from the final dividend on Austin Hoy shareholding.

Brig. Sir Harry Mackeson, the chairman, and his fellow directors of Austin Hoy, support the offer terms in respect of their own holding or control of 68,270 shares, and recommend acceptance to shareholders. The offer is subject to acceptance by not less than 90 per cent., or such lesser percentage as may be accepted, by November 13, or not later than December 4. In the event of the offer becoming unconditional it is proposed to pay Sir Harry, and Mr. R. P. Elliott, and Mr. Gourlay (also directors of Austin Hoy) a total of £1,500 between them as compensation for loss of office.

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PRESSED STEEL COMPANY, LIMITED—The interim dividend is being raised from 7½ per cent. to 9 per cent. for 1959. A 17½ per cent. final made 25 per cent. for 1958.

MIDLAND ALUMINIUM, LIMITED—An increased dividend of 15 (12½) per cent. with a final of 10 (7½) per cent. is being paid for the year ended June 30, 1959. Group profit advanced to £271,962 (£222.562), and after tax of £99.766 (£93,503), the net profit is higher at £119,337 (£84,058).

OXLEY ENGINEERING COMPANY, LIMITED—A final dividend of 12½ per cent., making 16½ per cent., less tax, is being paid for the year ended June 30, 1959, against a single payment of 10 per cent. in 1958. The company is also paying a further 2½ (nil) per cent., tax free. The group net profit is higher at £84,127 (£77,759).

RANSOME & MARLES BEARING COMPANY, LIMITED—The 17½ per cent. distribution is being effectively maintained with a final dividend of 10 per cent. and a bonus of 2½ per cent. for the year ended June 30, 1959. The previous total included a special interim of 2½ per cent. Group trading surplus is £1,182,056 (£1,423,755), and after tax of £563,771 (£756,400), the net profit is £609,396 (£666,581).

JOHN DALE, LIMITED, makers of non-ferrous collapsible tubes, aluminium and light-alloy castings, etc., of London, N.11—Since the announcement of agreement of terms for the proposed merger with Metal Closures, Limited, Winterbottom Industries, Limited, which also made an offer for the shares and loan stock of John Dale, has stated that the offer has lapsed as its condition has not been fulfilled. Acceptances so far received will be returned.

NORTH EAST COAST SHIPREPAIRERS, LIMITED—Payable December 15, an interim dividend of 3½ per cent. is announced by the company for the year ending March 31, 1960 on the £1,500,000 ordinary capital. A total of 11 per cent. was forecast last April. For the previous nine months a dividend of 10 per cent. was paid on a £750,000 capital prior to a one-for-five scrip issue and a £600,000 issue against the acquisition of Brigham & Cowan, Limited, engineers and dry dock owners, etc., of South Shields (Co. Durham).

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## Head Wrightson Plant for Colvilles

An order for the supply and construction of a blast-furnace gas-cleaning plant for the Ravenscraig Works, has been placed by the Scottish steelmakers, Colvilles, Limited, with Head Wrightson Iron & Steel Works Engineering, Limited, a subsidiary of Head Wrightson & Company, Limited, Thornaby-on-Tees (Yorks). The plant will mostly be manufactured by Head Wrightson at its Tees-side works.

The order is for an extension to a similiar plant constructed by the company two years ago at Ravenscraig and it forms part of the extensive strip mill project which Colvilles has undertaken. The complete plant will be capable of cleaning 15,000,000 cub. ft. per hour of blast-furnace gas and new equipment now to be supplied will comprise one gas-washing tower and two Head Wrightson Research Cottrell wet-tube electrostatic precipitators together with the necessary gas mains, valves, pumps, water mains, etc. Ancillary equipment will also be supplied for the handling and recovery of sludge from the circulating water system.

It is expected that the plant will be in commission by the middle of 1961. On completion it will be the 12th of this type to be supplied by Head Wrightson to the iron and steel industry during the last eight years. The value of the contract is about £357,000.

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## Alcan to increase Aluminium Production

Increase in production of 35,000 tons by its chief operating subsidiary, Aluminium Company of Canada, Limited, is announced by Aluminium, Limited. The present production is 530 000 tons a year. The increased production will be shared between three of the company's plants, Arvida, Quebec (17,000 tons), Shawinigan Falls, Quebec (10,000 tons), and Kitimat, British Columbia (8,000 tons). Expressed as a percentage the increase is 6.6 per cent.

The company says that the increased output at Shawinigan Falls and Kitimat will be effected fairly soon, while that at Arvida will take a "little while."

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## Nuclear Power Collaboration

Agreement between Humphreys & Glasgow, Limited, London, and Alco Products Incorporated, New York, in connection with nuclear power-station units of up to 30 mw capacity has been terminated by mutual consent.

Humphreys & Glasgow announces that it is prepared to offer a similar range of comprehensive power stations incorporating pressurized water reactors designed and manufactured by Babcock & Wilcox, Limited.

# European Mechanical Handling Federation

The seventh congress of the Fédération Européenne de la Manutention (European Mechanical Handling Federation), took place in Lucerne, Switzerland, from September 21 to 25. More than 250 industrialists from Austria, Belgium, Denmark, Germany, Great Britain, Finland, France, Holland, Italy, the Saar, Spain, Sweden, and Switzerland as well as from the affiliated association, the International Ropeway Association, participated in the congress. Certain representatives of the mechanical-handling industry of the USA were also present as observers.

It was reported at the congress that in addition to the work carried out by the individual sections, the following activities have also been undertaken.

### Customs Tariffs

A committee under the chairmanship of Mr. d'Yerville (France) has studied a draft for the establishment of a joint foreign customs tariff of the European Economic Community and has drawn up proposals which, through the intermediary of COLIME (Liaison Committee of the European Mechanical and Electrical Industries), have been transmitted to the appropriate committees in Brussels. The FEM has also established a close liaison with the International Standards Organisation (ISO) with a view to collaborating in the work undertaken or to be undertaken by the ISO and relating to mechanical-handling equipment and its component parts.

An inquiry had been sent to the different national committees and from information received it had been made possible to establish an index of the turnover figures relating to mechanical-handling appliances in the whole of the countries affiliated to the FEM. These were as follow: 1954, 100; 1955, 117; 1956, 138; 1957, 157; and 1958, 177.

The Council of Management and the general assembly of the FEM, under the chairmanship of Mr. Borthen (Sweden), president of the Federation, passed resolutions required for the administrative and financial management of the Federation and examined problems of general interest to the mechanical-handling industry.

It was also stated that a committee had been set up to study and prepare comments on "The General Conditions for the Supply and Erection of Plant and Equipment" published in Geneva in March, 1957, by the European Economic Commission of the United Nations Organization. These comments would show how these conditions should be interpreted in regard to the various types of equipment supplied by the members of the FEM.

In connection with the decision of the members of section 8 of the FEM (earth-moving equipment) to affiliate from now on with the European Construction Equipment Federation, this was approved, but in view of the fact that certain items of the equipment in question, while being for Public Works, were nevertheless involved in mechanical handling, it was stressed that a close liaison between the two organizations was desirable.

The steering committee of the FEM for the year 1960 will be composed as follows:—President, Mr. P. B. Silk (Great Britain); vice-presidents Mr. E. Turrinelli (Italy) and Mr. Frey (Switzerland); honorary presidents, Mr. J. d'Yerville (France) and Mr. G. Salzer (Germany). The permanent secretary is Mr. J. de Boissard (France). The eighth annual meeting of the Federation has been arranged for the end of June, 1960, and will take place in Stockholm, Sweden.

# Dinner

## JOINT IRON COUNCIL

A total of nearly 700 ironfounders, ironmakers, and guests attended the Annual Banquet of the Joint Iron Council held on Tuesday, of this week, at the Dorchester Hotel, London. The guest of honour was the Rt. Hon. Reginald Maudling, M.P., president of the Board of Trade (and who until recently was a Cabinet Minister closely associated with the Ministry of Power *i.e.* that principally concerned with the affairs of the iron industry). It was Mr. Maudling who proposed : "The Iron Industry," the first of the two toasts following that to the Queen. The response to this toast was ably made by Mr. N. P. Newman, J.P., president Joint Iron Council (and chairman and managing director of Newman, Hender & Company, Limited), who took the chair at the banquet. The second toast—to "The Guests"—was proposed by Mr. N. C. Macdiarmid, chairman of the Council of Iron Producers and a member of the executive of the JIC (also, managing director of Stanton Ironworks Company, Limited). In this case the response was made by Sir Cyril Musgrave, K.C.B., who succeeded to the chairmanship of the Iron and Steel Board in February this year, on the resignation of Sir Archibald Forbes, G.B.E.

During the evening a presentation was made to Mr. Brian Cook, aged 20, an apprentice employed by Bayliss, Jones & Bayliss, Wolverhampton. This took the form of a cash prize for being the best apprentice at the National Foundry Craft Training Centre during the period under review. This prize, the gift of the Worshipful Company of Founders, was awarded for the first time this year ; it was handed to Mr. Cook by Mr. Maudling.

As usual there was a large top table at the function, including—along with those attending the banquet —a wide representation of leading industrialists, Members of Parliament from both sides of the House ; men prominent in the foundry industry and in various industrial organizations. The formal proceedings concluded at about 10.30 p.m., when members and guests were left free to circulate at will amongst the gathering, renewing old acquaintances and making new friends.

# Correspondence

## NATIONAL WORKS VISITS

*To the Editor of the* FOUNDRY TRADE JOURNAL.

SIR,—Through your columns, may I express my surprise that despite the very encouraging caption "Welcome on the Mat" (JOURNAL, October 22), I have found to my cost that one of the companies only welcomes members of its employers' association, not members of the Institute of British Foundrymen who have organized this very popular event.

I made application to join the function during the first week after it was announced and was accepted for one of the visits. Then, seven days before the event, I was told my name was not acceptable to this firm because my company were not members of the particular employers' association.

How many other members have been affected by this "ban" which embarrassed both the IBF and its members ?

Yours etc.,

GEORGE I. DUFFIN.

Sutton-in-Ashfield.

# Personal

Mr. S. C. ANTHONY, F.I.M., has been appointed general manager of Aluminium Ingot Makers, Limited, Yeadon, Yorkshire.

Mr. JAMES A. ANDREW has been appointed to the board of McKechnie Brothers, Limited, as administration director.

As from November 9, the address of Mr. T. B. BURROWS will be "Lauderville," 48, Cambridge Road, Linthorpe, Middlesbrough.

Air Control Installations, Limited, Ruislip, Middlesex, announce that Mr. D. G. HILL has been appointed manager of the air-filter department.

Mr. JAMES E. ROBINSON, M.I.MECH.E., chief engineer of Hepworth & Grandage, Limited, has been appointed to the board of directors of the company.

Wickman, Limited, announce the appointment of Mr. R. J. DIXON as director and general manager of their machine-tool manufacturing company.

Mr. J. A. HARTLEY has been appointed a deputy managing director of Steele & Cowlishaw, Limited, of Hanley, a member of the Baker Perkins group.

Mr. J. K. VAUGHAN-MORGAN, M.P., who recently resigned as Minister of State, Board of Trade, has rejoined the board of the Morgan Crucible Company, Limited.

Mr. S. HALLAM, formerly depot manager at Netherton, Huddersfield, has been appointed manager of the David Brown Equipment Company, Limited, Meltham, near Huddersfield.

Mr. J. S. HASTIE, technical manager, has been appointed works director of the Renfrew factories of Scottish Cables, Limited. The new technical manager is Mr. J. T. HENDERSON.

The British Cast Iron Research Association announce the following appointments to the staff: Mr. P. DEWELL, B.Sc., to the foundry atmospheres section and Mr. W. R. ROBERTS, B.Sc., to the sand section.

Dr. M. G. SAY, Professor of Electrical Engineering at the Heriot-Watt College, Edinburgh, will give the annual Faraday Lecture in Sheffield on December 1. His subject will be electrical machines.

Sir LINCOLN EVANS, vice-chairman of the Iron and Steel Board, will be the guest speaker at the annual prize distribution of the education department of Samuel Fox & Company, Limited, at Stocksbridge on November 25.

Mr. L. SCHEPERS, a managing director of the Royal Dutch/Shell group of companies, has been appointed chairman of Shell Chemical Company, Limited, in succession to Mr. F. A. C. GUEPIN, who retired in June this year.

Mr. A. M. MACKAY has been appointed service manager, and Mr. B. P. GUARD London representative of the Bergius Company, Limited, diesel-engine manufacturers, Glasgow, a wholly-owned subsidiary of Associated British Engineering, Limited.

Mr. BERNARD UPTON, a departmental manager at Edward Pryor & Son, Limited, makers of marking devices, Broom Street, Sheffield, was presented with a stereophonic radiogram on October 26 to mark his 50 years' service with the firm.

To commemorate the completion of 60 years with Charles Roberts and Company, Limited, Railway Wagon Works, Horbury Junction, near Wakefield, the workpeople and staff have presented Mr. DUNCAN BAILEY, the firm's chairman, with an inscribed pen and pencil set.

Mr. WILLIAM L. MATHER, who is to take over the chairmanship of Mather & Platt, Limited, electrical, textile, hydraulic, and fire protection engineers, etc., of Manchester, on April 1, 1960, started a 33,000-mile business tour on October 30. He will visit some 20 countries.

Mr. JOHN MICHAEL EDDISON, an Aberdeen civil engineer, who left Britain two months ago to take up an appointment in Persia with Brian Colquhoun & Partners, has been awarded, by the Institution of Civil Engineers, 125 gns. from the Charles Hawksley Prize competition fund for his design of a highway viaduct.

The President of the Federation of Commonwealth and British Empire Chambers of Commerce, the Rt. Hon. the LORD LLOYD, M.B.E., and the High Commissioner for the Union of South Africa, His Excellency the Hon. Dr. A. J. R. VAN RHIJN, will be the principal speakers at the fourth annual dinner of the Institute of General Managers to be held at the Savoy Hotel, London, on November 27.

Mr. WALTER ANDERSON GALBRAITH, has been appointed general sales manager of the Yale & Towne Manufacturing Company's British Materials Handling Division at Wednesfield, Staffs. Mr. HARRY DAVIES, has been promoted from assistant sales manager (United Kingdom), to sales manager (United Kingdom) and Mr. MICHAEL JOHN STUART, from assistant sales manager (export) to sales manager (export).

Mr. JOHN RANNIE, shipyard director of John Brown & Company (Clydebank), Limited, has been reappointed president of the Clyde Shipbuilders' Association. Also reappointed were Mr. W. B. JOHNSTONE, a director of Alex. Stephen & Sons, Limited, Glasgow, and Mr. G. MORRISON, managing director of the Greenock Dockyard Company, Limited, as vice-presidents. Mr. J. B. CUNNINGHAME, secretary of Barclay Curle & Company, Limited, Glasgow, was appointed treasurer.

David Brown Industries, Limited, have presented DAVID THOMPSON, a student apprentice, with £50 in recognition of his outstanding achievement at Sheffield University. He went to the University's mechanical engineering department on an award from the firm, and later gained a technical State scholarship. In his final year, he has obtained the B.ENG. degree with first class honours; headed the honours list in mechanical engineering; shared the Mappin award for the outstanding performance in the faculty; won the John Brown prize of £50 for the student in mechanical engineering who, in addition to technical performance, had contributed most to the University's corporate life.

Following completion of the third development plan of the Steel Company of Wales, Limited, and in view of the retirement of Captain H. Leighton Davies, in June, 1960, the following appointments have been made to the board of the company. Mr. R. W. EVANS becomes a director and deputy general manager of the steel division. Mr. R. H. M. KINDERSLEY is made a non-executive member of the board. Mr. L. S. SCOTT-MAXWELL is appointed a director and general manager designate to the tinplate division to succeed Captain Leighton Davies next June. Mr. SHIRLEY GAZARD will become deputy general manager of that division from the same date. Captain Leighton Davies will continue as a consultant to the company after his retirement.

# News in Brief

THE ALUMINIUM COMPANY OF CANADA have announced that, to meet increasing world demand for aluminium products, it will increase production at Kitimat, British Columbia.

TWO WROUGHT-IRON gas lamp-posts, displaced by Mansfield Corporation's street-lighting electrification scheme, have been exported to Norway for use as ornaments at the entrance of an Oslo house.

MEMBERS of Wolverhampton Junior Chamber of Commerce visited the Bilston iron and steel works of Stewarts and Lloyds, Limited, on October 28. They saw a film showing the manufacture of iron and steel and afterwards toured the plant.

INSTRUMENTATION AND AUTOMATIC CONTROL for the recently-commissioned 100-ton oil-fired open-hearth furnace at the Glamorgan Works of the Briton Ferry Steel Company, Limited, has been supplied by George Kent, Limited, Luton, Bedfordshire.

Mr. OWEN TANNETT, managing director of Stanley Works (G.B.), Limited, Sheffield, who recently returned from a two-weeks business tour of Germany and Switzerland, said he considered that British industry can compete, quality for quality, with Germany anywhere and also sell in the German market.

A £3,500,000 SHIPBUILDING ORDER, has been secured by the Fairfield Shipbuilding & Engineering Company, Limited, Glasgow. It is for the construction of nine passenger ferries for Denizcilik Bankasi T.A.O. of Turkey. Each of the vessels will be capable of carrying 2,100 passengers operating on the Sea of Marmara and the Bosphorus.

A. V. ROE, CANADA, LIMITED, a member of the Hawker Siddeley Group, Limited, is negotiating with several US firms for contracts to handle assembly operations, an official of the company stated on October 24. It is also reported that Avro Aircraft, Limited, an A. V. Roe, Canada, subsidiary, may be planning to merge with the Kaiser Corporation, of the US.

A QUANTITY of iron ore found in the Thirthamalai region of Salem district, Madras (India), has been estimated at 47,500,000 tons. The ore is chiefly found as magnetite-Quartzite rock with an average iron-content of 35 to 40 per cent. Three private parties have already approached the Government for permission for each party to produce from these ores 15,000 tons of pig-iron per annum.

A NEW RANGE of Chieftain models will be introduced by Albion Motors, Limited, at the Scottish Motor Show, November 13 to 21. Also exhibited at the Show for the first time is the Albion Revier with twin driving axles at the rear. The new Chieftain series II is based on a 7-ton chassis with new Albion 5.5 litre 4-cylinder diesel-engine, fitted with 6-speed gearbox and standard driver's cab and the Reiver has a 10-ton 6-wheeled chassis.

BIRLEC, LIMITED, Erdington, Birmingham 24, announce the establishment of a South Wales area sales office in Cardiff. The area representative for South Wales is Mr. W. H. Statham, who has his headquarters at Associated Electrical Industries, Limited, Mervyn House, Frederick Street, Cardiff. Mr. Statham who joined Birlec in 1946, was, prior to this new appointment, a sales engineer in the furnace division of the company.

PRIESTMAN BROTHERS, LIMITED, excavator manufacturers, Hull, have received a further order, valued at £138,000, for excavators and replacements from the Polish Government. Shipments will commence from Hull during this month. The order is for 37 machines for use chiefly on land drainage. Priestmans had a similar order in May and this brings the total number of excavators supplied by the company to Poland, since the war, to over 120.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED, has cut the working week for the greater part of its work force from 44 to 42 hours. This was announced last week after a meeting between representatives of ICI and of no fewer than 23 trade unions involved. It is hoped the new hours will come into effect after January 4. There will be no corresponding loss of pay and it is estimated that the shorter hours will cost the company about £2,000,000 a year.

Mr. B. J. DUNCAN, field sales manager of W. C. Holmes and Company, Limited, Huddersfield, spoke to 75 leading Sheffield industrialists on the selection of dust collection and control plants at Sheffield Royal Victoria Hotel on October 27. He stressed the importance of the equipment because of the increasing demands of the Clean Air Act. A plant was recently installed at the Rotherham steelworks of Steel, Peech and Tozer Limited, at a cost of £25,000.

LOGAN MINING MACHINERY COMPANY, LIMITED, Lochee, Dundee, has changed its name to Logan Engineering, Limited. In a statement, the company said that for some time it had been felt the name did not reflect the scope of their activities, and that the new name would describe more accurately the general nature of the company's engineering facilities, which include precision engineering. No alteration was contemplated either in the control or management of the company.

ON OCTOBER 1, Shalco Corporation of Palo Alto, California, became a wholly-owned subsidiary of the National Acme Company, of Cleveland, Ohio. This latter company is now entering its 66th year as a producer of "automatic" lathes and a wide variety of machine-tools. Shalco shell-coremaking and moulding equipment will continue to be made under licence in the UK by Coleman-Wallwork, Limited. Mr. A. Woods remains as Shalco's European representative.

TANGYES, LIMITED, have been awarded the contract for the supply of hydraulic equipment to Canada Iron Foundries, Limited, who are to manufacture the tunnelling shields to excavate the Bloor University Avenue Subway in Toronto. The equipment consists of cylinders and rams, erector arms, and hydraulic pumps. The order, which is for $600,000 (approx. £200,000) worth of equipment, has been secured against keen international competition on both price and delivery by Tangyes of Canada, Limited, Montreal.

SHEFFIELD HEALTH COMMITTEE decided on October 26 to serve statutory notices on 56 people who have done nothing about the clean-air requirements in the city's No. 1 smokeless zone. Otherwise progress is reported to be very encouraging and assurances have been received from suppliers of the necessary appliances that they will be able to deal with the work required to make the zone virtually 100 per cent. smokeless by December 1. In the zone of 438 acres, there are 1,160 houses, 554 industrial concerns and 1,292 commercial premises.

HENRY WIGGIN & COMPANY, LIMITED, have been invited by the Mechanical and Production Engineering Department of Hatfield Technical College, Herts, to stage an exhibition as part of a "Nickel Survey" course which is being held at the College. The exhibition will be open from November 17 to 19, and in addition to demonstrations of the properties of Wiggin alloys, there will be on show complete aircraft gas

## *News in Brief*

turbines, one of the early Whittle engines, and over 300 examples of the type of plant component and sub-assembly for which the company's materials are used.

THE BOARD OF TRADE has issued particulars of a "call for tender" by the Water Supply Administration, Municipality of Addis Ababa, P.O. Box 1505, Mesfine Haarrar Street, Addis Ababa, for 115 items of pipe fittings. These include gate-valves, valves, suction strainers, tees, elbows, bends, nipples, plugs, unions, sockets, back-nuts, and galvanized bushes. A copy of the tender announcement, or a photostat copy, price 4s., may be obtained from the Export Services Branch of the BOT, Lacon House, Theobalds Road, London, W.C.1. The BOT reference number is ESB/25426/59. The closing date for receiving tenders is November 10.

AT THE FIRST of two foundry industry meetings to be held by the Manchester and District Productivity Association on November 10, in the Lesser Free Trade Hall, Manchester, a paper entitled "A Modern Steel Foundry for the Manufacture of Small Steel Castings by New Moulding Techniques" by Mr. John H. Osborn, M.P., M.A., Mr. T. A. Marsden and Mr. R. F. Horton, joint authors, was presented and supported by a film entitled "SOCAST Steel Castings." The paper and film dealt with the production of steel castings by the shell-mould, Osborn/Shaw and $CO_2$-block processes in the new foundry of Samuel Osborn & Company, Limited, Sheffield.

Dr. H. J. MANGOLD, Commercial Counsellor of the Embassy of the Federal Republic of Germany, accompanied by Dr. Stappert, head of the commercial department of the Embassy, and a number of German journalists were guests of the Brockhouse Organization at the group's head offices and works at Hill Top, West Bromwich, Staffs on October 15. After luncheon with the directors, the visitors toured the various divisions of J. Brockhouse & Company, Limited, the parent company of the group, and were later shown over the vehicle-spring making factory of Richard Berry & Son, one of the organization's subsidiary companies.

"PURCHASING AS AN AID TO PRODUCTIVITY" is the theme of a conference, organized by the Willesden & Hendon Productivity Committee, which will be held at the headquarters of the Federation of British Industries at 21 Tothill Street, London, S.W.1, on January 27, 1960. Both large and small organizations are expected to find the conference of special interest to management as well as people concerned with purchasing. The chairman will be Mr. M. Seaman, director and general manager of British Oxygen Engineering Company; the admission fee is two guineas, and and further particulars may be obtained from Mr. D. I. Duncan, A.E.I. Switchgear Division, 20 Neasden Lane, Willesden, N.W.10.

Mr. P. J. C. BOVILL, the Master Cutler, forecast a period of industrial expansion similar to that in the early 1950's, when he spoke at the 40th anniversary dinner of the Sheffield and District Works Sports Association on October 23. He said, "In the United Kingdom recently, productivity has gone up higher than it has ever done before. But the rate of increase is still slower than it should be." He added that "modern plant, new techniques and the co-operation of everybody who works in industry, from shop floor to the directors, were combined in the great growth they wanted to see. Industrial peace was needed with no bickerings or wildcat strikes, no tyrannies, and everybody having a share in the prosperity." Mr. D. W. Hammond, Association president, said the Association was the biggest and healthiest in the country.

BRIERLEY HILL COUNCIL at its meeting on October 22, stated that an alkali inspector of the Ministry of Housing recently met its Public Health Committee to discuss complaints which the Council had received about the increase in the smoke and fumes from the Round Oak Steel Works, and told committee members that "the problem of pollution caused by iron oxide, discharged from electric-arc furnaces in steelworks is not peculiar to Brierley Hill, but occurs wherever modern steelworks operate in this country." The Minister's inspector said that the new type of furnace now in use "presented fumes problems of a very difficult nature." Brieley Hill Council were reminded that under the Clean Air Act of 1956, steel-producing works were excluded from the control of local authorities and became the responsibility of alkali inspectors of the Ministry of Housing.

PROFESSOR M. STACEY of Birmingham University, guest speaker at the annual dinner recently of the Walsall branch of the National Union of Manufacturers, stressed that the economic survival of Britain would depend on the scientific and technological training of its young people coupled with their proper placement in industry. Speaking of his visits to the USA and to Russia, Professor Stacey said "I came back filled with a sense of apprehension and foreboding. With our scarcity of resources I wonder whether in 10 or 15 years we shall be able to compete." The ability to do so, he suggested, would depend on invention and discovery together with a more realistic use of the nation's resources. Britain was fortunate, he said, in being in the forefront of the world in developing uranium, but in many instances, discoveries had been made in Britain only to be developed later in America by young British scientists who had gone out there.

## *Obituary*

The death is reported of Mr. B. R. MILLAR, senior partner of Thomas Millar & Company (Engineers), Limited, Glasgow.

Mr. STANLEY HIRST, who has died at the age of 60, was chairman of Henry Brook & Company, Limited, ironfounders and structural engineers, Huddersfield.

Mr. FRANK DUDLEY HENSON, who since 1924 had been proprietor of T. Gibson & Sons, engineers and ironfounders, of Stamford (Lincs), died on October 21 at the age of 60.

Mr. THOMAS PEATTIE COCHRANE, who died on Thursday, October 22, was a director of Cochrane's (Bo'ness), Limited, engineers, shiprepairers, and boilermakers, etc., of Bo'ness (West Lothian).

**Railway-poster Advertising:** Quite a large number of foundry concerns use railway posters as a means of attracting custom. The latest to join the ranks is Le Grand Western Foundries, Limited. The poster illustrates a large casting and a handful of tiny castings and the public is informed that they are made less than 10 miles from Paddington Station.

# Raw Material Markets

## Iron and Steel

Consumption of pig-iron continues to expand, particularly for the low-phosphorus foundry and basic steel making grades. Demands for hematite and high-phosphorus pig-iron are also increasing, but to a much lesser extent than the other descriptions. Production of high-duty castings has been stepped up and the foundries connected with the motor vehicle trade are obtaining appreciable outputs, with present demands showing an increase on previous delivery schedules.

The machine-tool and steel industries are also calling for increased quantities of castings and these, together with the overall demands from many other users, enable the engineering and speciality foundries to obtain, in the main, satisfactory outputs. From railways and collieries, however, only moderate calls for castings are forthcoming. Low-phosphorus pig-iron is in heavy request by these foundries, and although several sources of supply are now available, some of the brands preferred by them are more difficult to secure, particularly for new customers, due to the increased demands and the present heavy commitments of the furnaces. Overall, however, sufficient supplies appear to be available to satisfy the needs of the foundries, apart from variations in analyses, chiefly in the phosphorus content. Increased supplies of hematite and refined irons are being accepted by these foundries, deliveries of which are adequate.

With the increased outputs of steel, which are now in the region of 90 per cent. of productive capacity, larger demands are made for basic pig-iron, although this is not being used as freely as it would have been if the supply of scrap was less plentiful. Producing furnaces are able to meet current demands without difficulty. Hematite producers are also benefiting by the heavier call from the steel trade for ingot moulds and castings.

Many of the light foundries maintain their improved outputs, mainly on account of the bigger demands for domestic equipment. Fairly good demands are being made for builders' castings, but the use of alternative materials in this industry continues to reflect against the foundries. While the call from these foundries for high-phosphorus pig-iron continues to improve, the furnaces still have tonnages to spare from current outputs, apart from the appreciable stocks held by them.

Pressure for the products of the re-rollers is sustained, and the mills are obtaining outputs on a vastly improved scale. Good demands are made for small bars and light sections and there continues to be a heavy call for reinforcing rods. Expanding demands are being made for steel semis, and some of the steelworks are committed for their outputs for two or three months ahead. Although efforts are continually being made by the re-rollers to book additional supplies for prompt delivery, difficulty is being experienced in obtaining these and doubt is expressed as to the ability of home steelworks to satisfy present requirements fully.

## Non-ferrous Metals

While there is still no sign of a settlement of the copper strike in the United States, that at Braden's El Teniente mine in Chile was virtually settled last week-end. The resumption of work there should ease the present stringent supply position somewhat, but, on the other hand, the White Pine Copper Company in the US, one of the few copper mines still in production, became strikebound towards the end of last week.

In London, prices, taking into account their considerable rise, are holding up reasonably well. But the market is very sensitive and the immediate outlook depends entirely on the US strike position. In the US custom smelters are still unquoted as to price, but reports indicate that metal for early delivery is fetching around 40 cents a pound, equivalent to £240 a ton. Producers are still showing a price of 31½ cents a pound, but this is a more or less nominal quotation.

Tin is quiet in the East, in the United States, and patchy in London. The most interesting report on this market has been the opinion that the amount of tin left in the buffer may now be as little as 6,500 tons. If this is so it may well be that the International Tin Council has directed the buffer stock manager to dispose of his entire stock so that the money which finances it can be repaid to the mining companies which put it up in the first place. In London the cash price is fluctuating narrowly around £794 a ton, while in the United States it is on offer below $1.02 a pound.

Lead is a reasonably stable market, with the price fractionally above £71 a ton in London and unchanged in New York at 13 cents a pound.

Zinc prices continue to rise, although the shortage of nearby metal appears to have eased. Demand is satisfactory, the outlook is still good, with the price in London not far short of £100 a ton, while it is now 12½ cents a pound, East St. Louis basis, against 12½-13 cents previously.

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**Cut in Babcock & Wilcox Interim**

Design and manufacture of nuclear and large boiler plant have necessitated a considerably greater amount of development work than was anticipated by Babcock & Wilcox, Limited, London, N.W.1, and the new processes involved have adversely affected and delayed production. Because of this the company has failed to maintain its rate of profit in 1959 to date, as forecast, and the interim dividend is reduced from 6 to 4½ per cent. A total of 13 per cent. was paid in 1958.

In spite of severe competition, state the directors, orders received in recent months have been encouraging in volume, although at reduced profit margins.

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**Mond Nickel Fellowships**

The Mond Nickel Fellowships Committee have now announced the award of a Fellowship for 1959 to the following applicants:—Mr. D. J. O. Mann (John Lysaght's Scunthorpe Works, Limited), to study the practical applications of recent metallurgical research and techniques to the production of basic semi-finished steel; and Mr. N. J. B. Pocock (Capper Pass & Son, Limited), to study developments in extractive metallurgy in the United Kingdom, Europe, the USA, and Canada, and their dependence on the size and location of the organizations concerned.

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**Photographic Paper**

The material formerly known as Kodak colour print paper type C has now been re-named "Ektacolor" paper. Its properties remain unchanged.

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LORD MILLS, the Paymaster General, will not now be able to be the principal speaker at the annual dinner of Sheffield Chamber of Commerce on November 10, as he has been commissioned to lead a Government mission to Australia. It was announced on October 27 that the place of Lord Mills at Sheffield will be taken by Mr. Frederick Errol, the Minister of State, Board of Trade, who will speak, it is expected, on the Government's views on industry and commerce.

# Current Prices of Iron, Steel, and Non-ferrous Metals

*(Delivered unless otherwise stated)*

**November 4, 1959**

## PIG-IRON

**Foundry Iron.**—No. 3 IRON, CLASS 2, 10-ton lots or over: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

**Low-phosphorus Iron.**—Over 0.10 to 0.40 per cent. P, 10-ton lots or over, £23 5s. 0d., delivered Birmingham, £23 10s. 0d., delivered Grangemouth.

**Cylinder and Refined Irons.**—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

**Refined Malleable.**—P, 0.10 per cent. max.: North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

**Hematite.**—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over: N.-E. of England (local iron), £24 14s. 0d.; Scotland (Scotch iron), Zone S.1, £25 0s. 6d.; Sheffield, £26 2s. 6d.; Birmingham, £26 9s. 0d.; Wales (Welsh iron), £24 14s. 0d.

**Basic Pig-iron.**—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

## FERRO-ALLOYS

*(Per ton unless otherwise stated, delivered)*

**Ferro-silicon** (6-ton lots and over).—45 per cent. Si, £40 0s. 0d. to £42 10s. 0d., scale 15s. 0d. per unit, lumpy; 75 per cent. Si, £54 0s. 0d. to £57 10s. 0d., scale 15s. 0d. per unit, lumpy.

**Ferro-vanadium.**—50/60 per cent., 22s. 6d. per lb. of V.

**Ferro-molybdenum.**—65/70 per cent., carbon-free, 12s. 10d. per lb. of Mo.

**Ferro-titanium.**—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

**Ferro-tungsten.**—80/85 per cent., 10s. 3d. per lb. of W.

**Tungsten Metal Powder.**—98/99 per cent., 13s. 3d. per lb. of W.

**Ferro-chrome** (6-ton lots and over, lumpy).—4/6 per cent. C, £77 0s. 0d. to £81 0s. 0d., basis 60 per cent. Cr, scale 26s. 0d. to 27s. 6d. per unit; over 6 per cent. C, £74 10s. 0d. to £77 10s. 0d., basis 60 per cent. Cr, scale 26s. 0d. to 27s. 6d. per unit; 2 per cent. C,* 1s. 7½d. to 1s. 10½d. per lb. Cr; 1 per cent, C,* 1s. 8d. to 1s. 11d. per lb. Cr; 0.15 per cent. C,* 1s. 9d. to 2s. 0d. per lb. Cr; 0.10 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.06 per cent. C,* 1s. 9¾d. to 2s. 0¾d. per lb. Cr.

**Metallic Chromium.**—98/99 per cent., 6s. 10d. per lb.

**Metallic Manganese.**—94/96 per cent., carbon-free, £245 0s. 0d.; 96/98 per cent., £275 0s. 0d.

**Ferro-columbium.**—65/67 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

**Ferro-manganese** (Standard).—78 per cent., £66 0s. 0d.

## SEMI-FINISHED STEEL

**Re-rolling Billets, Blooms, and Slabs.**—BASIC: Soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 6 to 35 tons, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), under 10 tons, £34 17s. 0d.; silico-manganese, under 10 tons, £43 16s. 6d.; free-cutting, under 10 tons, £36 14s. 6d. SIEMENS MARTIN ACID (under 10 tons): Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

**Billets, Blooms, and Slabs for Forging and for Stamping (under 10 tons).**—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

* Average 68-70 per cent.

## FINISHED STEEL

**Heavy Plates and Sections (under 10 tons).**—Ship plates, (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E. Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

**Small Bars, Sheets, etc.**—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 11s. 0d.

**Alloy Steel Bars.**—1 in. dia. and up; Nickel, £68 10s. 0d.; nickel-chrome, £99 4s. 0d.; nickel-chrome-molybdenum, £111 17s. 0d., in lots of 5 tons to under 10 tons.

## NON-FERROUS METALS

**Copper.**—Cash, £254 10s. 0d. to £255 0s. 0d.; three months, £244 0s. 0d. to £244 10s. 0d.; settlement, £255 0s. 0d.

**Copper Tubes, etc.**—Solid-drawn tubes, 2s. 5½d. per lb.; rods, 275s. 0d. per cwt. basis; 20 s.w.g., 310s. 0d. per cwt.

**Tin.**—Cash, £793 10s. 0d. to £794 0s. 0d.; three months, £795 10s. 0d. to £796 0s. 0d.; settlement, £794 0s. 0d.

**Lead (Refined Pig).**—First half November, £74 2s. 6d. to £74 5s. 0d.; first half February, £73 15s. 0d. to £73 17s. 6d.

**Zinc.**—First half November, £94 15s. 0d. to £95 5s. 0d.; first half February, £91 0s. 0d. to £91 10s. 0d.

**Zinc Sheets, etc.**—Sheets, 15g. and thicker, all English destinations, £130 15s. 0d.; rolled zinc (boiler plates), all English destinations, £128 10s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £107 10s. 0d.

**Brass Tubes, etc.**—Solid-drawn tubes, 2s. 0½d. per lb.; sheets to 10 w.g., 223s. 3d. per cwt.; wire, 2s. 10½d.; rolled metal, 223s. 3d. per cwt.

**Brass (Brazing).**—BS1400, B3, £166; B6, £217.

**Brass (High Tensile).**—BS1400, HTB1, £199; HTB2 £215; HTB3, £228.

**Gunmetal.**—BS1400, LG2, £207; LG3, £217; G1, 1% £272; G1, 1%, £259.

**Phosphor Bronze.**—BS1400, PB1 (AID released), £305; BS1400, 90/10/1, £287.

**Leaded Phosphor Bronze.**—BS1400, LPB1, £226.

**Phosphor Bronze Strip, etc.**—Strip, 314s. 0d. per cwt.; wire, 4s. 3¾d. per lb.; rods, 3s. 6¾d.; tubes, 3s. 6¾d.; chill cast bars; solids 3s. 6¼d.; cored 3s. 7¼d. (CHARLES CLIFFORD, LIMITED.)

**Nickel Silver, etc.**—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 11¾d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4¾d.; special quality turning rod, 10 per cent. ½ in. dia., in straight lengths, 4s. 3¾d. All prices are net.

**Other Metals.**—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £72 0s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, £251; AB2, £261.

## ECSC High Authority reorganizes Administration

A special session devoted to the reorganization of its working-groups and its administration was held by the new High Authority of the European Coal and Steel Community on Thursday and Friday, October 22 and 23.

The scope and balance of the High Authority's activities have been somewhat changed by the fact that the problem of the co-ordination of energy policy within the Community has become of primary importance and that this will henceforward determine its policy on coal. The patterns of importance attached to the different work carried out by the Authority and its various services also have altered during the period of transition.

By re-grouping, greater concentration, and co-ordination it is hoped to arrive at a simpler administrative system. Most of the division will be grouped into a limited number of departments under directors-general.

There will now be seven groups within the Authority each with its own president as follows:—Rules of Competition (including Rules of Transport), vice-president, Mr. Oppe; External Relations and Information, Mr. Wehrer; Social Problems, Mr. Finet; Finance and Investment Mr. Potthoff; Economic Policy and Industrial Reconversion, Mr. Reynaud; Co-ordination of Energy Policy, Mr. Lapie; Coal and Steel Market, Mr. Hellwig.

By limiting the number and composition of the working-groups, the president, Mr. Malvestiti will be able to call upon his vice-president, Mr. Spierenburg (who has not been made president of any of the working-groups), for greater help in his (the president's) many tasks.

## *Board Changes*

DAVID ROWAN & COMPANY, LIMITED—Mr. Horace Willson has retired from his position as chairman. His successor is Mr. W. Simon Wilson.

WILLIAM HAMILTON & COMPANY, LIMITED—Mr. Horace Willson has been elected president of the company and ceases to occupy the positions of chairman and managing director. Sir William Lithgow has been elected chairman.

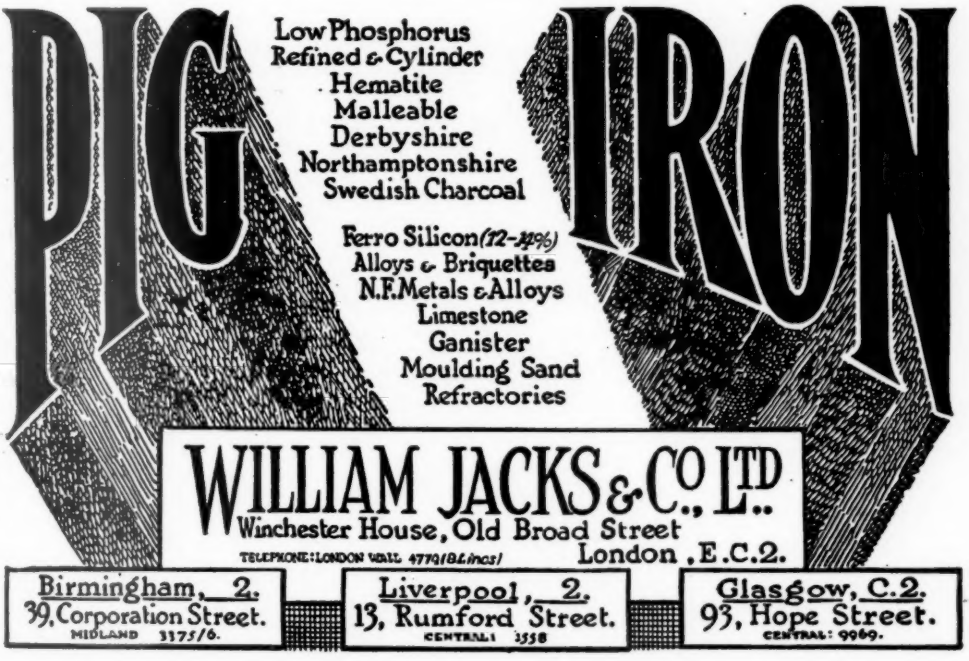
CARDINAL STEELS, LIMITED—Mr. Robert G. Young has been appointed a director and general manager. Mr. Geoffrey Edwards has resigned as managing director of the company and its subsidiary, Gillotts Forge & Rolling Mills, Limited, but remains on the boards of both companies.

DOWTY GROUP, LIMITED—Mr. J. C. G. Wegerif, assistant managing director of the Bentley Engineering Group, Limited, has been appointed an additional director. The board of Bentley Engineering has agreed to allow Mr. Wegerif to give some of his time to the Dowty Group's broader production policy, made necessary by new developments now reaching a production stage.

### Recent Wills

DAKIN, G. E., of Hunslet, Leeds, iron and steel merchant, governing director of T. Burns, Dakin, Limited ... ... ... ... ... ... ... £58,135

MACHARG, SIR ANDREW, former deputy chairman of the Clydesdale & North of Scotland Bank, Limited, chairman of A. & J. Main & Company, Limited, and a director of a number of companies including the North British Locomotive Company, Limited, Bairds & Dalmellington, Limited, and the Gourock Rope Company, Limited ... £167,380

## Publications Received

**Publicity and Promotion.** Issued by the Vitreous Enamel Development Council, Limited, 28, Welbeck Street, London, W.1.

This 12-page brochure tells of the progress made by the Vitreous Enamel Development Council since its inception some three years ago. Besides arranging lectures and film shows, the Council has taken space at exhibitions and advertised in the Press and through the medium of television. Future plans include a change for the better in its slogan from "Glass on Steel—the Lifetime Finish"—which is not sufficiently comprehensive—to "Genuine Vitreous Enamel—the Lifetime Finish." The contents of the booklet include the use of vitreous enamel in hardware, architecture, and on aluminium. It is a very lively publication, worthy of study by other employers' associations.

**Quick Guide to the Nickel-containing Casting Alloys.** Issued by the International Nickel Company, Inc., 67, Wall Street, New York, N.Y., U.S.A.

*Multum in parvo* has always been the predominant feature of this 28-page booklet. In this issue, through the incorporation of six fold-out pages, space has been made available to outline, in table form, the application in 12 industries of three varieties of steel, two ductile irons, three sorts of cast iron, four different bronzes and four "others." The last column of the table refers the reader to a page number, where more information is given as to usage and mechanical properties of the alloys entering the main groups.

**British Standards Institution, Annual Report. 1958-9.** Published by the Institution from 2, Park Street, London, W.1; price 7s. 6d.

This Report should not be confused with the Year Book of the British Standards Institution, which is regarded as a valuable work of reference to those seeking information on standards. The Annual Report includes a general statement of the activities of the Institution, a number of divisional reports, notes on international activities, and finally, a list of the personnel of the various Councils, committees and officers. The number of licences issued permitting the use of the Kite mark is now 1,404, an increase of five over the previous year.

**The Iron Dale,** by Victor Lewis, and illustrated by Alan Carr Linford. Published by the Stanton Ironworks Company, Limited, near Nottingham.

Anyone who receives this 48-page book can indeed count themselves fortunate, for it is magnificently produced, beautifully illustrated, and clearly written. It covers the history of Stanton Dale, which, in mediæval days, was graced by an imposing abbey. The story tells of the beginning of the now great Stanton enterprise, its growth and its conduct towards its workpeople. It is indeed a proud record, and one which makes fascinating reading. The reviewer congratulates those responsible for having done such an excellent piece of work.

**Field Report. No. 56—Foundry Equipment.** Issued by AFSA, Limited, 25 Victoria Street, London, S.W.1.

This *Bulletin* is a small collection of extracts from reports from foundries expressing the satisfaction derived from the use of various types of Molykote lubricants. The uses include lubrication of roller-bearings on mould-oven cars: air hammers; dressings for die-castings and for the ball-bearings used in the de Lavaud system for centrifugally-cast pipes.

## House Organ

**The Forge, No. 7.** Published by J. Brockhouse & Company, Limited, Victoria Works, Hill Top, West Bromwich, Staffs.

This issue carries an excellent article on the two die-casting foundries operated by Kaye Alloy Castings, Limited—one in Birmingham and the other in Presteigne, North Wales. The latter factory is mainly concerned with pressure-die-castings, and the following is an abstract from an article covering a phase of control.

One of the features of the foundry operation is the employment of the "Centralograph" system for recording continuity of machine operation. Each of the machines is connected to this system, every shot being recorded on a chart in the office with a record of the time interval. Thus the duration of any waiting time, stoppage or breakdown is shown on the chart, and each day the chart is analysed and compared with shop reports. Also at each machine is a dial of telephone type by means of which the operator can record a number on the "Centralograph" chart to indicate the reason for a given stoppage: thus dialling three may indicate an electrical breakdown while five may signify a die change.

## Book Review

**A.W.S. Training Manual for Arc Welding.** Published by the American Welding Society, 33 West 39th Street, New York, 18, USA. (UK enquiries to Chapman & Hall, Limited, 37, Essex Street, London, W.C.2.)

This is a practical textbook for trainee electric welders which gives sufficient simplified technical information to enable the reader to understand the practical limitation and applications of the arc-welding process. A series of 30 exercises are detailed, giving full information regarding current, size of electrode and method of accomplishment for a wide range of electric-welding problems.

The care and maintenance of welding plant is discussed at sufficient length to enable the operator to diagnose the more general faults and assist in their rectification. The section dealing with "Metals and Their Structure" is fully illustrated with diagrams and visual comparison charts. Process, physical and welding metallurgy are introduced in their basic fundamentals.

D. BEYNON.

## Forty Years Ago

With the exception of a series of excellent technical papers, the November 1919 issue of the JOURNAL was of poor vintage. However, an article on the making of column patterns was noteworthy for the particularly clear and informative illustrations. It is interesting to note from another article in this issue that a new American stress-testing machine was belt driven. A description was also given of an extensometer designed by Mr. (later Dr.) J. E. Hurst and Mr. G. A. Tomlinson, which the writer does not recall ever having encountered before. Amongst new companies listed in this issue were Alloy Castings, Limited and Patent Die Castings Company, Limited.

FIRTH-VICKERS STAINLESS STEEL COMPANY, LIMITED, Weedon Street, Sheffield, were awarded the Grand Challenge Cup for the best stand in the industrial section at the London Dairy Show.

*Electrical Aids in Industry* *Data Sheet* **No. 8**

# Light-Sensitive Cells

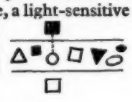
*What are light-sensitive cells?* They are devices which can sense and measure changes in the level of light or, in some cases, respond to the quality of light falling on them. There are various types of cell and each has its particular field of use. One of the best known is the photo-electric cell.

*What can light-sensitive cells do?* A change in the amount of light falling on the cell can cause a switch, relay or counter to operate. Alternatively, the direct indication of the light intensity can often allow some other factor to be determined and, if required, controlled. They are reliable and require little maintenance. Careful installation, as with all types of equipment, gives a good reward.

*How can they be used?* These cells have many applications in industry, for controlling processes, for inspection and measurement, for sorting material and for safety purposes:

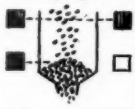
### *Counting*

Where objects on a conveyor belt are too soft or light to operate a direct mechanical counting device, where they are too delicate or freshly painted to sustain physical contact or where the articles vary in size, a light-sensitive cell can be used. This counts the objects by interruption of an appropriately sited beam of light.



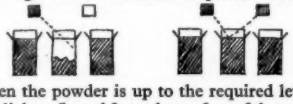
### *Hopper or Tank Level Control*

Many forms of feed can be accurately controlled by light cells. One important one is for controlling the input to a hopper of fluid solids such as sand or peas. Here, two horizontal light beams are required: the upper, when interrupted, indicates that the hopper is full and stops the supply; the lower, when it ceases to be interrupted, indicates that the hopper is nearly empty and restarts the flow.



### *Package Content*

The level of powder in packages can be checked with light cells. The cell is so positioned that



when the powder is up to the required level, the light reflected from the surface of the powder is picked up by the cell and causes the carton to be accepted. If not, it is rejected.

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### *Colour Sorting*

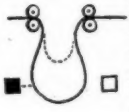
The quality of many articles can be gauged by their colour—seeds and nut kernels, for instance. The objects are fed into a tube by means of a vibrator pan and fall into the beams of three equally spaced light cells which scan them from all sides. If the object is acceptable it falls into a chute carrying it to one conveyor; if its colour is bad it is deflected as a reject.

### *Guillotine Guard*

Light cells for guarding a guillotine or power press should be used only as a supplement to a mechanical guard or where the latter is impracticable. The interruption of a curtain of light by a hand stops the machine instantaneously.

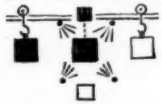
### *Press Feeding*

Where the rate of feed of strip metal must be suited to a varying speed of acceptance by a press, a loop of the strip is allowed to sag between the feed and the press. When the loop reaches a predetermined depth a light beam is interrupted and the slack is taken up.



### *Processing Objects on the Move*

Many articles are processed while on a conveyor line. For instance, where articles are to be sprayed while on the conveyor, the paint saved by stopping the gun between articles will make the device worthwhile. The same principle applies in a bakery to the spraying of baking tins with fat.



### *Automatic Door Opening and Closing*

Doors can be caused to open or close by the interruption of a beam of light. This has its uses in such cases as control of doors on a heating oven or for the passage of vehicles in a factory. This is effected by a light beam on the side from which the approach is made (in many cases, both). When the approach beam is interrupted it opens the door which closes again after a given time interval.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association.

An excellent series of reference books are available (8/6, or 9/- post free) on electricity and productivity — "Higher Productivity" is an example. E.D.A. also have available on free loan a series of films on the industrial uses of electricity. Ask for a catalogue.

*Issued by the*
*Electrical Development Association*
*2 Savoy Hill, London, W.C.2*

# Imports and Exports of Iron and Steel in September

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in September. Totals for the first nine months of this year and last are also included.

## *Total Exports of Iron and Steel*

| Destination. | Month ended Sept. 30. | Nine months ended Sept. 30. | |
|---|---|---|---|
| | 1959. | 1958. | 1959. |
| | Tons. | Tons. | Tons. |
| Cyprus | 85 | 4,590 | 1,243 |
| Sierra Leone | 910 | 10,172 | 7,917 |
| Ghana | 1,266 | 12,113 | 21,034 |
| Nigeria | 3,691 | 49,498 | 54,895 |
| Union of South Africa | 2,038 | 75,607 | 30,526 |
| Rhodesia and Nyasaland | 1,061 | 27,906 | 15,454 |
| Tanganyika | 2,257 | 9,900 | 15,241 |
| Kenya | 1,907 | 31,366 | 17,515 |
| Uganda | 50 | 2,442 | 3,268 |
| Mauritius | 131 | 2,596 | 1,088 |
| Aden | 202 | 2,366 | 2,205 |
| Bahrein, Qatar, and Trucial States | 805 | 6,879 | 5,984 |
| Kuwait | 243 | 33,580 | 7,944 |
| India | 17,704 | 101,850 | 138,483 |
| Pakistan | 6,227 | 45,778 | 30,605 |
| Singapore | 2,712 | 25,682 | 17,222 |
| Malaya | 850 | 11,388 | 7,868 |
| Ceylon | 1,326 | 29,380 | 31,347 |
| British North Borneo | 85 | 1,707 | 1,870 |
| Hongkong | 4,720 | 43,249 | 49,265 |
| Australia | 5,271 | 75,204 | 59,866 |
| New Zealand | 10,007 | 140,167 | 71,760 |
| Canada | 27,292 | 135,719 | 148,530 |
| Jamaica | 1,253 | 16,422 | 15,970 |
| Trinidad | 3,649 | 38,178 | 30,926 |
| British Guiana | 638 | 5,656 | 5,140 |
| Other Commonwealth countries | 2,266 | 29,564 | 26,942 |
| Eire | 3,932 | 37,417 | 35,401 |
| Soviet Union | 7,508 | 14,985 | 20,708 |
| Finland | 3,325 | 38,548 | 26,329 |
| Sweden | 14,287 | 92,257 | 89,170 |
| Norway | 10,519 | 66,880 | 68,679 |
| Denmark | 6,229 | 66,338 | 68,879 |
| Western Germany | 14,897 | 35,856 | 90,592 |
| Netherlands | 6,546 | 61,203 | 71,209 |
| Belgium | 8,594 | 22,914 | 27,973 |
| France | 517 | 3,485 | 2,532 |
| Switzerland | 1,124 | 7,340 | 6,857 |
| Portugal | 1,080 | 10,984 | 11,610 |
| Spain | 1,136 | 36,060 | 21,454 |
| Italy | 3,395 | 34,046 | 37,877 |
| Austria | 298 | 8,140 | 2,645 |
| Yugoslavia | 334 | 3,400 | 2,614 |
| Greece | 388 | 10,666 | 8,238 |
| Turkey | 48 | 3,726 | 4,469 |
| Netherlands Antilles | 123 | 1,470 | 1,992 |
| Portuguese East Africa | 246 | 1,894 | 1,176 |
| Egypt | 20 | 11,729 | 2,150 |
| Sudan | 366 | 28,651 | 5,721 |
| Lebanon | 551 | 8,566 | 2,369 |
| Israel | 921 | 5,580 | 11,299 |
| Saudi Arabia | 8 | 3,649 | 2,866 |
| Iraq | 3,071 | 27,452 | 58,070 |
| Iran | 2,290 | 29,836 | 23,246 |
| Burma | 375 | 7,903 | 6,646 |
| Thailand | 247 | 5,186 | 6,295 |
| Indonesia | 638 | 1,617 | 4,053 |
| Philippine Republic | 1,972 | 2,920 | 6,149 |
| USA | 18,919 | 59,890 | 133,846 |
| Cuba | 315 | 4,318 | 5,236 |
| Columbia | 1,039 | 4,886 | 2,773 |
| Venezuela | 2,841 | 56,478 | 54,293 |
| Ecuador | 98 | 2,092 | 811 |
| Peru | 205 | 8,678 | 1,994 |
| Chile | 90 | 4,105 | 1,069 |
| Uruguay | 41 | 812 | 771 |
| Argentina | 19,819 | 108,211 | 161,918 |
| Other foreign countries | 29,134 | 91,816 | 214,050 |
| TOTAL | 266,132 | 1,989,937 | 2,125,937 |

## *Total Imports of Iron and Steel*

| From | Month ended Sept. 30. | Nine months ended Sept. 30. | |
|---|---|---|---|
| | 1959. | 1958. | 1959. |
| | Tons. | Tons. | Tons. |
| Rhodesia and Nyasaland | 376 | 5,116 | 4,056 |
| Canada | 1,153 | 16,513 | 13,309 |
| Other Commonwealth countries and Eire | 5,021 | 18,558 | 26,815 |
| Soviet Union | 12,765 | 108,238 | 41,787 |
| Sweden | 3,129 | 27,622 | 21,336 |
| Norway | 6,328 | 55,592 | 62,169 |
| Poland | 218 | 173 | 3,723 |
| Western Germany | 9,340 | 62,999 | 53,828 |
| Netherlands | 11,622 | 106,889 | 122,462 |
| Belgium | 1,194 | 85,268 | 16,871 |
| Luxembourg | 240 | 5,645 | 4,913 |
| France | 2,012 | 16,176 | 16,387 |
| Italy | 1,687 | 5,337 | 10,973 |
| Austria | 451 | 3,743 | 3,157 |
| Japan | 228 | 2,777 | 1,958 |
| USA | 367 | 114,320 | 19,551 |
| Other foreign countries | 481 | 4,038 | 9,345 |
| TOTAL | 56,612 | 639,004 | 432,640 |
| Iron and steel scrap and waste, fit only for the recovery of metal | 21 | 60,415 | 2,509 |

## *Exports of Iron and Steel by Products*

| Product. | Month ended Sept. 30. | Nine months ended Sept. 30. | |
|---|---|---|---|
| | 1959. | 1958. | 1959. |
| | Tons. | Tons. | Tons. |
| Pig-iron | 10,827 | 103,557 | 104,905 |
| Ferro-columbium (niobium) | 7 | 29 | 39 |
| Ferro-tungsten | 92 | 541 | 869 |
| Other ferro-alloys | 1,458 | 2,589 | 6,008 |
| Ingots, blooms, billets, slabs, sheet bars (incl. tinplate bars), and similar primary forms | 9,510 | 12,521 | 60,087 |
| Pieces roughly shaped by forging* | 180 | 5,793 | 1,176 |
| Iron bars, rods, angles, shapes, and sections | 762 | 1,153 | 1,581 |
| Steel bars, rods, angles, sections, and shapes | 60,122 | 244,727 | 320,964 |
| Iron plates and sheets | — | 1,241 | 287 |
| Universal plates | 2,179 | 3,345 | 7,379 |
| Steel plates, 3mm. and under 4.5mm. thickness | 2,157 | 6,312 | 30,159 |
| Ditto, 4.5mm. or more in thickness | 21,949 | 132,717 | 142,936 |
| Blacksheets and blackplate | 24,900 | 210,099 | 199,507 |
| Hoop and strip | 4,999 | 51,424 | 61,718 |
| Tinplate | 36,992 | 281,685 | 349,746 |
| Decorated tinplate | 415 | 2,553 | 6,493 |
| Galvanized sheets | 5,110 | 59,433 | 65,004 |
| Other (incl. tinned sheets, terneplate, and ternesheets) | 1,425 | 10,138 | 16,179 |
| Railway and tramway construction material | 5,981 | 189,813 | 116,086 |
| Wire rods of steel (incl. alloy steel) | 3,434 | 27,212 | 35,957 |
| Wire | 8,660 | 76,277 | 78,469 |
| Tubes, pipes, and fittings | 55,973 | 566,778 | 520,388 |
| TOTAL | 266,132 | 1,989,937 | 2,125,937 |

* The figures for 1959 are not completely comparable with those or previous years.

BRANCH OFFICE of Elliott Bros. (London), Limited (a member of the Elliott-Automation, Limited, group), in south-west England and South Wales is now at 55, Westgate Chambers, Newport, Mon (telephone: Newport 65710).

EXTENSION TO THE Glasgow headquarters of Stewarts and Lloyds, Limited, was completed last week. It is the third addition to the building originally erected in 1902.

**at Stand W380 at the Building Exhibition Olympia**

If you have a dust problem, we have an answer to it—an answer based on over 30 years' specialisation in industrial dust collection. During that time, we've settled pretty well every kind of industrial dust: metal, wood, plastic, food, chemical, and so on. We've done it with the help of up-to-the-minute scientific research and the widest range of equipment made in this country: filters, large and small unit collectors, wet collectors (particularly useful for fine or explosive dust), and complete plant installations. All our collectors are self-cleaning and are designed for either fully or semi-automatic operation.
See us for dust—and settle it once and for all.

***DALLOW LAMBERT*** ***dust control equipment for industry***

DALLOW LAMBERT & COMPANY LIMITED, THURMASTON, LEICESTER

CRC 83

# Pig-iron and Steel Production

*Statistical Summary of August Returns*

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table 1 summarizes activities during recent months. Table 2 gives production of steel ingots and castings in August. Table 3, weekly average production of finished steel in July. Table 4 gives the production of pig-iron and ferro-alloys in August, and furnaces in blast. (All figures are weekly averages in thousands of tons).

TABLE 1.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.*

| Period. | B.o.T. Price Index, 1938 = 100. | | | Iron-ore output. | Imported ore used. | Coke sent to blast-furnaces. | Pig-iron, ferro-alloys prod. | Scrap used in steel prod. | Steel (incl. alloy). | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Iron and steel. | Coal. | Basic materials | | | | | | Imports.[1] | Prod. ingots, castings. | Delivrs. finished steel. | Stocks.[2] |
| 1957 .. .. | 328 | 488 | 537 | 325 | 303 | 270 | 275 | 220 | 14 | 417 | 322 | 1,444 |
| 1958 .. .. | 343 | 503 | 478 | 276 | 262 | 227 | 245 | 196 | 9 | 369 | 284 | 1,542 |
| 1959—May | 342 | 487 | 478 | 292 | 236 | 203 | 240 | 211 | 8 | 385 | 285 | 1,457 |
| June[3] | 338 | 487 | 475 | 285 | 232 | 204 | 235 | 214 | 9 | 388 | 292 | 1,425 |
| July .. | 338 | 487 | 472 | 275 | 226 | 201 | 222 | 169 | 7 | 320 | 245 | 1,436 |
| Aug. .. | 338 | 487 | 479 | 264 | 212 | 193 | 220 | 172 | 5 | 337 | — | 1,499 |

TABLE 2.—*Average Weekly Production of Steel Ingots and Castings in August*, 1959.

| District. | Open-hearth. | | Bessemer. | Electric. | All other. | Total. | | Total ingots and castings. |
|---|---|---|---|---|---|---|---|---|
| | Acid. | Basic. | | | | Ingots' | Castings. | |
| Derbys, Leics, Notts, Northants, and Essex .. | — | 4.6 | 14.6 (basic) | 1.4 | 0.1 | 19.6 | 1.1 | 20.7 |
| Lancs (excl. N.W. Coast), Denbighs, Flints and Ches .. .. .. .. | 0.5 | 28.4 | — | 2.6 | 0.3 | 30.8 | 1.0 | 31.8 |
| Yorks (excl. N.E. Coast and Sheffield) .. .. | | | | | | | | |
| Lincs .. .. .. .. .. | — | 47.0 | — | — | 0.1 | 47.0 | 0.1 | 47.1 |
| North-East Coast .. .. .. .. .. | 0.3 | 56.4 | — | 0.8 | 0.2 | 56.6 | 1.1 | 57.7 |
| Scotland .. .. .. .. .. | 0.9 | 37.8 | — | 2.0 | — | 39.3 | 1.4 | 40.7 |
| Staffs, Shrops, Worcs, and Warwicks .. .. | — | 15.8 | — | 3.0 | 0.6 | 18.0 | 1.4 | 19.4 |
| South Wales and Monmouthshire .. .. | 1.0 | 70.0 | 5.7 (basic) | 0.4 | 0.1 | 76.9 | 0.3 | 77.2 |
| Sheffield (incl. small tonnage in Manchester) .. | 4.2 | 24.9 | — | 9.0 | 0.2 | 37.0 | 1.3 | 38.3 |
| North-West Coast .. .. .. .. .. | — | — | 3.8 (acid) | 0.4 | — | 4.2 | — | 4.2 |
| Total .. .. .. .. .. | 6.9 | 284.9 | 24.1 | 19.6 | 1.6 | 329.4 | 7.7 | 337.1 |
| July, 1959 .. .. .. .. .. | 9.2 | 264.8 | 24.0 | 20.6 | 1.7 | 312.6 | 7.7 | 320.3 |
| August, 1958 .. .. .. .. .. | 9.4 | 250.6 | 21.9 | 15.7 | 1.6 | 291.5 | 7.7 | 299.2 |

TABLE 3.—*Deliveries of Non-alloy and Alloy Finished Steel.*

| Product. | 1957. | 1958. | 1958. | 1959. | |
|---|---|---|---|---|---|
| | | | July.* | June.* | July. |
| *Non-alloy steel:* | | | | | |
| Ingots, blooms, billets and slabs[4] | 5.0 | 4.6 | 3.2 | 4.9 | 4.2 |
| Heavy rails .. | 11.2 | 10.2 | 8.8 | 7.4 | 5.7 |
| Sleepers .. .. | 1.3 | 1.2 | 1.1 | 1.0 | 0.1 |
| Fish and soleplates | 0.8 | 0.7 | 1.1 | 0.6 | 0.5 |
| Plates: | | | | | |
| (i) Over ⅜ in. thick .. .. | 34.0 | 29.6 | 23.6 | 23.2 | 16.0 |
| (ii) Under ⅜ in... | 20.3 | 17.7 | 14.9 | 19.3 | 16.2 |
| Other heavy prod. | 53.0 | 41.8 | 29.9 | 39.2 | 28.5 |
| Ferro-concrete bars | 8.9 | 7.6 | 8.0 | 10.6 | 10.5 |
| Wire rods .. .. | 23.3 | 21.5 | 17.9 | 25.4 | 17.4 |
| Arches, etc. .. | 11.0 | 8.6 | 6.5 | 7.9 | 5.7 |
| Other light sections | 38.7 | 29.1 | 22.2 | 33.7 | 26.6 |
| Bright steel bars .. | 7.0 | 6.2 | 5.0 | 7.5 | 6.6 |
| Hot-rolled strip .. | 23.1 | 22.6 | 19.3 | 29.0 | 23.3 |
| Cold-rolled strip .. | 7.1 | 7.0 | 5.9 | 8.1 | 7.1 |
| Sheets, .. .. | | | | | |
| (i) Hot rolled .. | 13.0 | 10.6 | 9.2 | 12.6 | 11.2 |
| (ii) Cold rolled .. | 29.1 | 31.1 | 27.6 | 35.5 | 29.0 |
| Tinplate: | 18.8 | 18.7 | 18 6 | 20.7 | 23.8 |
| Blackplate.. .. | 1.0 | 0.8 | 0.8 | 0.7 | 0.9 |
| Tubes up to 16 in... | 22.1 | 19.0 | 16.5 | 20.1 | 19.0 |
| Tube, and pipe f'tgs | 0.5 | 0.4 | 0.3 | 0.3 | 0.3 |
| Tyres, wheels, axles | 5.1 | 4.5 | 3.6 | 2.2 | 1.5 |
| Forgings (excl.drop) | 3.1 | 2.6 | 2.3 | 2.0 | 1.9 |
| Steel castings .. | 4.6 | 4.2 | 3.3 | 3.6 | 3.0 |
| Tool and magnet | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 |
| Total .. .. | 342.3 | 300.5 | 249.8 | 315.7 | 259.2 |
| *Alloy steel* .. .. | 17.8 | 16.1 | 13.2 | 18.8 | 15.1 |
| Total from UK[5] .. | 360.1 | 316.6 | 263.0 | 334.5 | 274.3 |
| Imported steel .. | 9.6 | 7.1 | 4.6 | 7.3 | 8.0 |
| *Deduct:* Intra-industry conversions[6] .. | 369.7 48.2 | 323.7 41.2 | 267.6 32.4 | 341.8 50.7 | 282.3 38.5 |
| New material .. | 321.5 | 282.5 | 235.2 | 291 1 | 243.8 |

TABLE 4.—*Production of Pig-iron and Ferro-alloys*

| District. | Furnaces in blast. | Hematite. | Basic. | Foundry. | Forge. | Ferro-alloys. | Total. |
|---|---|---|---|---|---|---|---|
| Derbys, Leics, Notts, Northants and Essex | 19 | — | 21.7 | 17.4 | 0.7 | — | 39.8 |
| Lancs (excl. N.W. Coast), Denbighs, Flints. and Ches .. | 6 | — | 15.3 | — | — | 1.4 | 16.7 |
| Yorks (excl. N.E. Coast and Sheffield) .. | — | — | — | — | — | — | — |
| Lincs .. .. | 8 | — | 39.3 | — | — | — | 39.3 |
| North-East Coast | 15 | 1.4 | 38.9 | — | — | 0.7 | 41.0 |
| Scotland .. .. | 5 | — | 14.4 | 1.2 | — | — | 15.6 |
| Staffs, Shrops, Worcs, and Warwicks .. | 4 | — | 5.7 | 0.9 | — | — | 6.6 |
| S. Wales and Monmouthshire | 9 | 3.0 | 41.3 | 0.4 | — | — | 44.7 |
| Sheffield .. | 2 | — | 3.2 | — | — | — | 3.2 |
| North-West Coast | 6 | 11.2 | — | 0.6 | — | 0.9 | 12.7 |
| Total .. | 74 | 15.6 | 179.8 | 20.5 | 0.7 | 3.0 | 219.6 |
| July, 1959 .. | 74 | 19.3 | 180.0 | 18.3 | 1.0 | 3.0 | 221.6 |
| August, 1958 .. | 84 | 17.6 | 177.4 | 22.9 | 0.2 | 2.9 | 221.0 |

[1] Weekly average of calendar month.

[2] Stocks, mainly ingots and semi-finished, at the end of the year and months shown.

[3] Five weeks, all tables.

[4] Other than for conversion into any other form of finished steel listed.

[5] Includes finished steel produced in the UK from imported ingots and semi-finished steel.

[6] Material for conversion into other products also listed in this table.